Bacterial Implementation Plan Development for the Chickahominy River and Tributaries
Technical Report

Prepared for:
Virginia Department of Environmental Quality
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New River-Highlands RC&D

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ACKNOWLEDGMENTS

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Local citizens and stakeholders in the Chickahominy River watershed

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EXECUTIVE SUMMARY

The Chickahominy River and tributaries watershed above the tidal limit have been listed as impaired on Virginia's *303(d) Total Maximum Daily Load Priority List and Report* since 2002 due to violations of the State's water quality standards for fecal coliform bacteria. This means that the waterways do not support primary contact recreation including swimming, wading, and fishing due to an increased risk of illness or infection when coming in direct contact with the water. A total maximum daily load (TMDL) study was developed for the Chickahominy River and selected tributaries in 2012. The study area also includes subwatersheds for which TMDLs have been completed prior to the Chickahominy River TMDL. These areas include Upham Brook bacteria TMDL which was completed in 2008 and White Oak Swamp bacteria TMDL which was completed in 2004. These TMDLs were all conducted in accordance with the Clean Water Act (CWA, §303d). These studies established the bacterial reductions necessary to meet water quality standards for bacteria to fully support the recreation/primary contact designated use.

Virginia's Water Quality Monitoring, Information, and Restoration Act (WQMIRA, §62.1-44.19:4) requires implementation plans (IPs) be developed for waterbodies with approved TMDL studies in order to provide one path by which the pollutant reductions may be met. To fulfill this goal, a framework was established to achieve bacteria water quality standards for the impaired Chickahominy River and tributaries above the tidal limit utilizing the completed TMDL studies as guidance.

Review of TMDL Development

Modeling conducted in support of the Chickahominy River TMDL considered fecal bacteria loads in runoff resulting from wildlife (*e.g.,* deer, raccoon, muskrat, beaver, turkey, goose, and duck), livestock (*e.g.,* beef, dairy and horse), and residential (*e.g.,* failing septic systems, straight pipes, dogs and cats) sources. Direct loads to the stream (including direct deposition from cattle and wildlife), uncontrolled discharges (failing septic systems and straight pipes), and permitted sources were also modeled. The *E. coli* geometric mean standard (126 cfu/100 mL) with an implicit Margin of Safety (MOS) was used as the water quality endpoint. Sources within Upham Brook and White Oak Swamp were updated and included in the modeling.

The final load reduction scenarios for meeting the water quality standard for bacteria in the Chickahominy River and tributaries impairments showed all failing septic systems and straight pipes should be identified and corrected, and reductions in bacteria from residential, and agricultural runoff is needed (**Table ES. 1**). Reductions were also needed from wildlife direct and land-based sources.

Table ES. 1 Final bacteria load reduction scenarios to meet the WQS for the study area.

Impairment	Wildlife Direct*	Wildlife Land Based*	Livestock Direct	Agricultural Land Based	Human Direct (Straight Pipes and SSOs)**	Human and Pet Land Based
Chickahominy River watershed	77%	77%	100%	99%	100%	99%

*Direct and land-based wildlife bacteria reductions will not be explicitly addressed by this implementation plan (see Section 1.2.2)
** SSOs are addressed through Virginia Pollutant Discharge Elimination System (VPDES) permitting, compliance, and enforcement actions (see Section 7.1).

Public Participation

The actions described in this document have been constructed based on recommendations from local citizens, local government representatives, Virginia Departments of Conservation and Recreation (VADCR), Environmental Quality (VADEQ), and Health (VDH), Colonial Soil and Water Conservation District (SWCD), Henricopolis SWCD, Hanover-Caroline SWCD, City of Richmond (COR), county governments, citizen organizations, and MapTech, Inc. Every citizen and interested party in the watershed is encouraged to become involved in implementing the plan to help restore the health of the Chickahominy River and tributaries.

Public meetings were conducted to distribute information and gain feedback from the community. Active participation was solicited in smaller forums called working groups. These groups were comprised of stakeholders with similar concerns (*e.g.*, agricultural, residential, and government). Representatives from each working group participated in the Steering Committee, where input from the working groups was reviewed and decisions about the IP were made. Throughout the public participation process, a major emphasis was placed on discussing best management practices (BMPs), BMP specifications, locations of control measures, education,

and sanitary sewer overflows (SSOs) with reductions needed in wildlife direct and land-based sources.

Opinions were voiced throughout the public participation meetings regarding what should be included in the implementation plan. Most members of the working groups agreed that the cornerstone of the implementation plan should be cultivating public involvement and education, as well as encouraging partnerships between the citizens and government agencies in order to reduce fecal bacteria in Chickahominy River watershed.

Assessment of Implementation BMPs

The quantity or extent of pollution control measures, or BMPs, recommended for implementation was determined through spatial analyses of land use, stream-networks, and topography, along with regionally appropriate data archived in the VADCR Agricultural BMP Database. Input from state and local agency representatives and community members was used to verify the analyses. The collective BMPs required to meet the TMDL reduction goals for all impairments within the Chickahominy River watershed for a 10-year implementation period were identified and are shown in **Table ES. 2**.

The measures shown in Table ES.2 are broken down into two stages, Stage I and Stage II. The staged implementation of the measures allows for a review of improvement to assess if measures in Stage II are actually needed or not. This approach allows for most cost effective measures to be implemented first. Though wildlife contributions are not directly addressed, there are actions which communities may take to educate citizens and effectively manage nuisance wildlife populations (Section 1.2.2.).

Table ES. 2 Stage I and Stage II implementation goals.

BMPs	Unit	Stage I Units	Stage II Units	Cost per Unit	Stage I Cost ($)	Stage II Cost ($)	Total Cost
Agricultural BMPs							
Livestock Exclusion with Riparian Buffer (LE-1T)	System	13	0	$15,000	$195,000	$0	$195,000
Stream Protection (WP-2T)	System	2	0	$8,000	$16,000	$0	$16,000
Cattle Fencing on Intermittent Stream	System	41	0	$15,000	$615,000	$0	$615,000
Non-cost-share Horse Fencing	System	29	29	$30,000	$870,000	$870,000	$1,740,000
Improved Pasture Management (NRCS 528)	Acre	11,623	11,622	$150	$1,743,450	$1,743,300	$3,486,750
Conservation Tillage – Cropland (SL-15A)	Acre	419	0	$100	$41,900	$0	$41,900
Riparian Buffers – Cropland	Feet	10,000	10,000	$1	$10,000	$10,000	$20,000
Retention Ponds - Cropland	Acre-Treated	0	3,000	$200	$0	$600,000	$600,000
Retention Ponds - Pasture	Acre-Treated	0	13,850	$200	$0	$2,770,000	$2,770,000
Streamside Fence Maintenance	Feet	0	8,939	$3.50	$0	$31,287	$31,287
Waste Storage/Composting/Education – Horse	System	143	47	$3,000 per system + $21,500	$450,500	$141,000	$591,500
Technical Assistance	FTE	7.5	7.5	$60,000	$450,000	$450,000	$900,000
Subtotal					**4,391,850**	**6,615,587**	**11,007,437**
Residential BMPs							
Septic Systems Pump-outs (RB-1)	System	5,234	5,234	$450	$2,355,300	$2,355,300	$4,710,600
Septic System Repair (RB-3)	System	100	0	$3,500	$350,000	$0	$350,000
Septic System Installation/Replacement (RB-4)	System	75	0	$8,000	$600,000	$0	$600,000
Alternative Waste Treatment System Installation (RB-5)	System	2	0	$20,000	$40,000	$0	$40,000
Sewer Connection	System	245	0	$32,000	$7,840,000	$0	$7,840,000
Pet Waste Pick-up/Composters Program	Program	75%	25%	$370,976	$278,232	$92,744	$370,976
Retention Ponds – Mixed (pervious and impervious)	Acre-Treated	0	5,000	$1,356	$0	$6,780,000	$6,780,000
Rain Gardens Level 1 Design - Pervious	Acre-Treated	175	175	$19,000	$3,325,000	$3,325,000	$6,650,000
Rain Gardens Level 1 Design – Impervious	Acre-Treated	75	75	$94,000	$7,050,000	$7,050,000	$14,100,000
Bioretention Facilities Level 1 Design - Pervious	Acre-Treated	35	105	$19,000	$665,000	$1,995,000	$2,660,000
Bioretention Facilities Level 1 Design - Impervious	Acre-Treated	15	45	$94,000	$1,410,000	$4,230,000	$5,640,000
Vegetated Buffers	Feet	10,000	10,000	$1	$10,000	$10,000	$20,000
Residential Education Program	Program	100%	0%	$11,500	$11,500	$0	$11,500
Technical Assistance	FTE*	7.5	7.5	$60,000	$450,000	$450,000	$900,000
Subtotal					**$24,385,032**	**$26,288,044**	**$50,673,076**
IP Total					**Stage I $28,776,882**	**Stage II $32,903,631**	**$61,680,513**

*FTE is annual Full Time Equivalent

Cost/Benefit Analysis

The costs of the above control measures were determined based on the cost of control measures previously installed through the Virginia Cost-Share Program in the Chickahominy River watershed and nearby watersheds, discussions with local agency representatives and working groups, and literature review.

The primary benefit of implementation is the reduction of *E. coli* bacteria in these streams. With the completion of this implementation plan, the risk of illness or infection contracted through recreating in these streams should decrease significantly. Streambank protection, provided through exclusion of livestock from streams, will also lead to improved aquatic habitat. The practices recommended in this document will provide economic benefits to landowners in addition to the anticipated environmental benefits.

Pet Waste Pick-up program, Horse Waste Storage/Composting/Education, retention ponds on pasture, and pasture management are the most cost-effective measures that contribute to bacteria reduction in the Chickahominy River watershed.

Measurable Goals and Milestones for Attaining Water Quality Standards

Potential funding sources available during implementation were identified during plan development. Sources may include, but are not limited to:

- Federal Clean Water Act Section 319 Incremental Funds
- Virginia Agricultural Best Management Practices Cost-Share Program
- Virginia Agricultural Best Management Practices Tax Credit Program
- USDA Environmental Quality Incentives Program (EQIP)
- Virginia Revolving Loan Programs
- USDA Wildlife Habitat Incentive Program (WHIP)
- Virginia Water Quality Improvement Fund

Implementation is scheduled to occur in two main stages. The first stage involves implementation of the most cost-effective control measures. Stage II describes the remainder of the control measures required to achieve the targeted pollutant load reductions and fully achieve the reductions called for in the TMDL studies.

Wildlife bacteria reductions are not called for in the IP. However, nuisance wildlife planning should be considered by watershed communities where they are needed.

While SSO reductions are necessary to realize water quality improvements, these are actions which are addressed with facilities through permitting, compliance, and enforcement actions under purview of DEQ. Moreover, and even though localities are conducting major improvements to address the issue of SSOs, completely eliminating SSOs is a monumental task that may never be realized.

Identification of critical areas to be targeted first for residential BMP installation was accomplished through analysis of bacteria loads from human and dog sources. Targeting may increase the effectiveness of BMPs by reducing more bacteria per dollar invested.

In addition to future DEQ assessments of impaired waters, success may also be evaluated by the number of BMPs implemented in the watershed. The use of adaptive management strategies will provide flexibility for BMP implementation.

Stakeholders and Their Role in Implementation

Implementation progress success will be determined by water quality monitoring conducted by VADEQ through the agency's monitoring program.

The Soil and Water Conservation Districts (SWCDs) will be in charge of initiating contact with farmers and homeowners in the impaired watersheds to encourage the installation of agricultural BMPs. The SWCD staff will conduct outreach activities in the watersheds to garner the participation and community support necessary to achieve implementation milestones, and to make the community aware of the water quality impairments present in the Chickahominy River watershed and how they may affect local residents.

VDH responds to homeowners who report septic malfunctions and failures or complaints and concerns expressed from the public about a given system.

In the Commonwealth of Virginia, water quality problems are managed via legislation, incentive programs, education, and legal actions. The agencies regulating activities that impact water quality in Virginia include: VADEQ, VADCR, Virginia Department of Agriculture and

Consumer Services (VDACS), and VDH. Should citizens observe an issue which may impact environmental quality, they are urged to contact the regional DEQ office or report the incident online (www.deq.virginia.gov). If the issue presents an imminent threat to human health or the environment, citizens should contact the Department of Emergency Management (www.vaemergency.gov).

The achievement of water quality restoration goals is dependent on the participation of all watershed stakeholders. Therefore, everyone in the watershed has an obligation to identify what BMPs are applicable and implementable based on the impacts their actions may have on water quality. For more information on how to do your part to improve water quality, your local Soil and Water Conservation District (http://vaswcd.org/) may be contacted.

An Implementation Plan describes a scenario of Best Management Practices which are aimed at achieving the pollutant reductions outlined in a TMDL study. The BMPs chosen in this IP are not the only types which stakeholders can choose to implement; rather they are merely options among many. DEQ does not intend for the IP to be a prescriptive document, rather, it is a tool that watershed stakeholders may use to reach watershed bacteria reduction goals. While the development of an IP is required by Virginia state law, all of the BMPs outlined in the IP document are voluntary practices. The implementation of BMPs will not be done by any one locality, city, non-profit organization, or government agency. Rather, all stakeholders including citizens, will be responsible for implementing BMPs in the watershed in order to reach the bacteria reduction goals outlined in the TMDL. Again, this document outlines one scenario by which those goals can be achieved.

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1. INTRODUCTION

1.1 Background

The detrimental effects of bacteria in food and water supplies have been documented repeatedly. Throughout the United States, the Centers for Disease Control estimates that at least 73,000 cases of illnesses and 61 deaths per year are caused by *E. coli* 0157:H7 bacteria (CDC, 2001). Other fecal coliform (FC) pathogens (*e.g., E. coli* 0111) are responsible for similar illnesses. In addition, the presence of other bacterial and viral pathogens is indicated by the presence of fecal bacteria. Whether the source of contamination is human, livestock, or pet waste, the threat of these pathogens appears more prevalent as these populations increase. As stakeholders, we must assess the risk we are willing to accept and then implement measures to safeguard the public from these risks.

The Clean Water Act (CWA) that became law in 1972 requires that all U.S. streams, rivers, and lakes meet their state's water quality standards. The CWA also requires that states conduct monitoring to identify polluted waters or those that do not meet standards. Through this required program, the state of Virginia has found that many stream segments do not meet state water quality standards for protection of the six beneficial uses: recreation/swimming, aquatic life, wildlife, fish consumption, shellfish consumption, and public water supply (drinking).

When streams fail to meet standards, Section 303(d) of the CWA and the U.S. Environmental Protection Agency's (EPA) Water Quality Management and Planning Regulation (40 CFR Part 130) both require that states develop a Total Maximum Daily Load (TMDL) for each pollutant. A TMDL is a "pollution budget" for a stream. That is, it sets limits on the amount of pollution that a stream can receive and still maintain water quality standards. In order to develop a TMDL, background concentrations, point source loadings, and non-point source loadings are considered. A TMDL accounts for seasonal variations and must include a margin of safety. Through the TMDL process, states establish water-quality based controls to reduce pollution and meet water quality standards.

Once a TMDL is developed and approved by the State Water Control Board (SWCB) and EPA, measures must be taken to reduce pollution levels in the stream. Virginia's 1997 Water Quality

Monitoring, Information and Restoration Act (WQMIRA) states in section 62.1-44.19:7 that the "Board shall develop and implement a plan to achieve fully supporting status for impaired waters". The TMDL Implementation Plan (IP) describes control measures, which can include the use of better treatment technology and the installation of best management practices (BMPs), to be implemented in a staged process.

The Chickahominy River and some of its tributaries have been listed as impaired on VADEQ's *303(d) Total Maximum Daily Load Priority List and Reports* due to violations of the State's water quality standards for fecal bacteria (**Figure 1.1**).

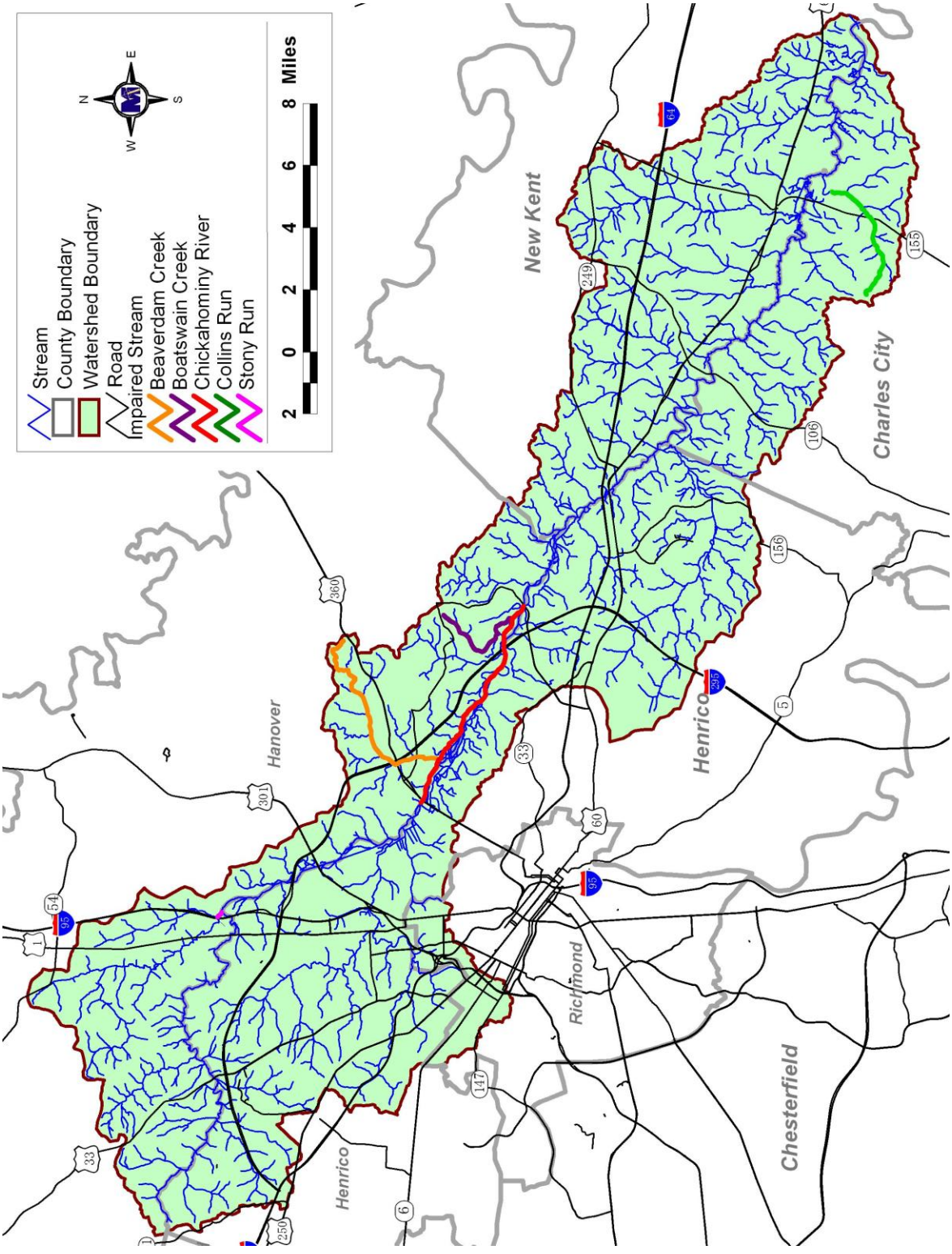

Figure 1.1 Location of the impairments within the IP project area.

The impaired segment on the Chickahominy River (VAP-G06R_CHK01A98) was added to the 2008 impaired waters list for not supporting the recreation/swimming use. This impaired segment extends from the Route 360 bridge downstream the Route 156 bridge (7.54 stream miles based on the 2010 assessment). VADEQ monitoring station 2-CHK062.57 had a bacteria standard violation rate of 12% in the 2010 assessment. This segment borders Henrico and Hanover counties.

Collins Run in Charles City County, VA flows northeast into the Chickahominy River near river mile 30. Collins Run is listed as impaired from its headwaters to river mile 0.99. It was initially listed in 2002 as impaired for not supporting the recreation/swimming use. VADEQ monitoring at station 2-CNR001.58 showed a 33% bacteria standard violation rate in the 2010 assessment.

Beaverdam Creek, in Hanover County, flows south before its confluence with the Chickahominy River. Beaverdam Creek from its headwaters to its mouth (6.69 stream miles) was listed as impaired on the 2006 303(d) list for not supporting the recreation/swimming use. VADEQ monitoring station 2-BEV002.00 had a 27% violation rate in the 2010 assessment.

Boatswain Creek, in Hanover County, flows south before its confluence with the Chickahominy River. Boatswain Creek from its headwaters to its mouth (3.76 stream miles) was initially listed as impaired on the 2006 303(d) list for not supporting the recreation/swimming use. VADEQ monitoring station 2-BTS002.62 had a 31% violation rate in the 2010 assessment.

Stony Run, in Hanover County, flows south-east before its confluence with the Chickahominy River. Stony Run from its confluence with Lickinghole Creek to its mouth (0.21 stream miles) was listed as impaired on the 2004 303(d) list for not supporting the recreation/swimming use. VADEQ monitoring station 2-SNF000.04 had a 27% violation rate in the 2010 assessment.

In developing this IP, elements from both state and federal guidance were incorporated and the recommended guidelines from Virginia's *Guidance Manual for Total Maximum Daily Load Implementation Plans* were followed. Specific state and federal requirements of an IP are described in chapter 2 of this document.

Once developed, the Virginia Department of Environmental Quality (VADEQ) will take TMDL implementation plans to the SWCB for approval as the plan for implementing the pollutant

allocations and reductions contained in the TMDLs. Also, VADEQ will request SWCB authorization to incorporate the TMDL implementation plan into the appropriate Water Quality Management Plan (WQMP) in accordance with the CWA's Section 303(e). In response to a Memorandum of Understanding (MOU) between EPA and VADEQ, VADEQ also submitted a draft Continuous Planning Process to EPA in which VADEQ commits to regularly updating the WQMPs. Thus, the WQMPs will be, among other things, the repository for all TMDLs and TMDL implementation plans developed within a river basin.

1.2 Applicable Water Quality Standards

According to 9 VAC 25-260-5 of Virginia's State Water Control Board *Water Quality Standards*, the term "water quality standards" means "…provisions of state or federal law which consist of a designated use or uses for the waters of the Commonwealth and water quality criteria for such waters based upon such uses. Water quality standards are to protect the public health or welfare, enhance the quality of water and serve the purposes of the State Water Control Law and the federal Clean Water Act."

As stated in Virginia state law 9 VAC 25-260-10 (Designation of uses),

> *A. All state waters, including wetlands, are designated for the following uses: recreational uses, e.g., swimming and boating; the propagation and growth of a balanced, indigenous population of aquatic life, including game fish, which might reasonably be expected to inhabit them; wildlife; and the production of edible and marketable natural resources, e.g., fish and shellfish.*
>
> ◆
>
> *D. At a minimum, uses are deemed attainable if they can be achieved by the imposition of effluent limits required under §§301(b) and 306 of the Clean Water Act and cost-effective and reasonable best management practices for nonpoint source control.*

Virginia adopted its current *E. coli* standard in January 2003 and was updated in June 2008. *E. coli* is bacteriological organism that can be found in the intestinal tract of warm-blooded animals; there is a strong correlation between these and the incidence of gastrointestinal illness. Like fecal coliform bacteria, these organisms indicate the presence of fecal contamination.

The criteria which were used in developing the bacteria TMDL in this study are outlined in Section 9 VAC 25-260-170 (Bacteria; other recreational waters) and read as follows:

A. The following bacteria criteria (colony forming units (cfu)/100mL) shall apply to protect primary contact recreational uses in surface waters, except waters identified in subsection B of this section:

E. coli bacteria shall not exceed a monthly geometric mean of 126 cfu/100mL in freshwater.

1. *See 9VAC25-260-140 C for boundary delineations for freshwater, transition and saltwater.*
2. *Geometric means shall be calculated using all data collected during any calendar month with a minimum of four weekly samples.*
3. *If there [are] insufficient data to calculate monthly geometric means in freshwater, no more than 10% of the total samples in the assessment period shall exceed 235 E. coli cfu/100mL.*
4. *If there [are] insufficient data to calculate monthly geometric means in transition and saltwater, no more than 10% of the total samples in the assessment period shall exceed enterococci 104 cfu/100mL.*
5. *For beach advisories or closures, a single sample maximum of 235 E. coli cfu/100mL in freshwater and a single sample maximum of 104 enterococci cfu/100mL in saltwater and transition zones shall apply.*

Sufficient bacteria standard violations were recorded at VADEQ water quality monitoring stations to indicate that the recreational use designations are not being supported in the streams listed in Section 1.1.

1.2.1 Designated Uses

All waters in the Commonwealth have been designated as "primary contact" for the swimming use regardless of size, depth, location, water quality or actual use. The *E. coli* bacteria standard is described in 9 VAC 25-260-170 and in Section 1.2 of this report. This standard is to be met during all stream flow levels and was established to protect bathers from ingestion of potentially harmful bacteria and associated pathogens. However, many headwater streams are small and shallow during base flow conditions when surface runoff has minimal influence on stream flow. Even in pools, these shallow streams do not allow full body immersion during periods of base flow. In larger streams, lack of public access often precludes the swimming use.

Recognizing that all waters in the Commonwealth are not used extensively for swimming, Virginia has approved a process for re-designation of the swimming use for secondary contact in cases of: 1) natural contamination by wildlife, 2) small stream size, and 3) lack of accessibility

to children, as well as due to widespread socio-economic impacts resulting from the cost of improving a stream to a "swimmable" status.

The re-designation of the current swimming use in a stream will require the completion of a Use Attainability Analysis (UAA) and the approval of a designated use removal or use modification by the SWCB. A UAA is a structured scientific assessment of the factors affecting the attainment of the use, which may include physical, chemical, biological, and economic factors as described in the Federal Regulations. The stakeholders in the watershed, Virginia, and EPA will have an opportunity to comment on these special studies, should they be developed.

1.2.2 Wildlife Contributions

In some streams for which TMDLs have been developed, water quality modeling indicates that even after removal of all of the sources of *E. coli* (other than wildlife), the stream will not attain standards. TMDL allocation reductions of this magnitude are not realistic and do not meet EPA's guidance for reasonable assurance. Based on the water quality modeling, many of these streams will not be able to attain standards without some reduction in wildlife bacteria loads. Virginia and EPA are not proposing the reduction of wildlife to allow for the attainment of water quality standards. This is obviously an impractical action. While managing over-populations of wildlife remains an option to local stakeholders, the reduction of wildlife or changing a natural background condition is not the intended goal of a TMDL.

Virginia has a 'general management plan' for deer and geese, but these plans are on a statewide resolution level. On a case by case basis, Virginia Department of Game and Inland Fisheries (VDGIF) will help with the management of geese in urban settings. This will generally occur after local government and citizen management efforts have failed to discourage Canada Geese from an area.

Communities can develop nuisance wildlife management plans which provide education to residents on a variety of methods to mitigate the harmful impacts the over-population may be causing on water quality. First and foremost, citizens should evaluate and assess conditions which are contributing to the over-population. A common cause of nuisance wildlife is residents who continually feed them. Often, it is this human behavior which is most difficult to change but is frequently the most critical action which can be taken to discouraging nuisance

wildlife habitation. A management plan may also include the addition of streambank vegetation and establishment of no-mow zones which make water-to-land access more difficult and increase riparian buffer capacity, utilizing trained canines such as border collies to intimidate and discourage geese, addling eggs, and introducing natural predators such as snapping turtles to help restore population balance. It is imperative that a community recognize that no single action will create change; rather, it is necessary to develop a comprehensive nuisance wildlife management plan which incorporates aspects of both education of residents and on-the-ground practices in order to achieve results long term. To learn more about how to develop a community wildlife management plan, please visit the Department of Game and Inland Fisheries website (www.dgif.virginia.gov) or consult your local extension agent office (http://www.ext.vt.edu/).

In such a case, after demonstrating that the source of *E. coli* contamination is natural and uncontrollable by effluent limitations and BMPs, the state may decide to re-designate the stream's use for secondary contact recreation or to adopt site specific criteria based on natural background levels of *E. coli*. The state must demonstrate that the source of *E. coli* contamination is natural and uncontrollable by effluent limitations and BMPs through a UAA as described above. All site-specific criteria or designated use changes must be adopted as amendments to the water quality standards regulations. Watershed stakeholders and EPA will be able to provide comment during this process.

1.3 Project Methodology

The overall goal of this project was to begin the process of restoring water quality in the Chickahominy River and its watershed.

In fulfilling the state's requirement for the development of a TMDL IP, a framework has been established for reducing *E. coli* levels and achieving the water quality goals for the Chickahominy River and tributaries for which TMDL allocations were developed. With successful completion of the IP, Virginia will be well on the way to restoring the impaired waters and enhancing the value of this important resource. Additionally, development of an approved IP will improve the localities' chances for obtaining monetary assistance during implementation.

2. STATE AND FEDERAL REQUIREMENTS FOR IMPLEMENTATION PLANS

There are a number of state and federal requirements and recommendations for TMDL IPs. The goal of this chapter is to clearly define what they are and explicitly state if the "elements" are a required component of an approvable IP or are merely a recommended topic that should be covered in a thorough IP. This chapter has three sections that discuss a) the requirements outlined that must be met in order to produce an IP that is acceptable and approvable by the Commonwealth, b) the EPA recommended elements of IPs, and c) the required components of an IP in accordance with Section 319 guidance.

2.1 State Requirements

The TMDL IP is a requirement of Virginia's 1997 Water Quality Monitoring, Information, and Restoration Act (§62.1-44.19:4 through 19:8 of the Code of Virginia), or WQMIRA. WQMIRA directs the SWCB to "develop and implement a plan to achieve fully supporting status for impaired waters." In order for IPs to be approved by the Commonwealth, they must meet the requirements as outlined by WQMIRA. WQMIRA requires that IPs include the following:

- date of expected achievement of water quality objectives,
- measurable goals,
- necessary corrective actions, and
- associated costs, benefits, and environmental impact of addressing the impairment.

Virginia also has a guidance manual for the development of IPs (http://www.deq.virginia.gov/Portals/0/DEQ/Water/TMDL/ImplementationPlans/ipguide.pdf).

2.2 Federal Recommendations

Section 303(d) of the CWA and current EPA regulations do not require the development of implementation strategies. The EPA does, however, outline the minimum elements of an approvable IP in its 1999 *Guidance for Water Quality-Based Decisions: The TMDL Process.*

The listed elements include:

- a description of the implementation actions and management measures,
- a time line for implementing these measures,
- legal or regulatory controls,
- the time required to attain water quality standards, and
- a monitoring plan and milestones for attaining water quality standards.

It is strongly suggested that the EPA recommendations be addressed in the IP, in addition to the required components as described by WQMIRA.

2.3 Requirements for Section 319 Fund Eligibility

The EPA develops guidelines that describe the process and criteria used to award CWA Section 319 nonpoint source grants to States. The guidance is subject to revision and the most recent version should be considered for IP development. The "Supplemental Guidelines for the Award of Section 319 Nonpoint Source Grants to States and Territories in FY 2003" identifies the following nine elements that must be included in the IP to meet the 319 requirements:

1. Identify the causes and sources or groups of similar sources that will need to be controlled to achieve the load reductions estimated in the watershed-based plan;
2. Estimate the load reductions expected to achieve water quality standards;
3. Describe the NPS management measures that will need to be implemented to achieve the identified load reductions;
4. Estimate the amounts of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon to implement the watershed-based plan.
5. Provide an information/education component that will be used to enhance public understanding of the project and encourage the public's participation in selecting, designing, and implementing NPS management measures;
6. Provide a schedule for implementing the NPS management measures identified in the watershed-based plan;
7. Describe interim, measurable milestones for determining whether NPS management measures or other control actions are being implemented;
8. Identify a set of criteria for determining if loading reductions are being achieved and if progress is being made towards attaining water quality standards; if not, identify the criteria for determining if the watershed-based plan needs to be revised; and
9. Establish a monitoring component to evaluate the effectiveness of the implementation efforts.

3. REVIEW OF TMDL DEVELOPMENT

MapTech, Inc. developed *E. coli* bacteria TMDLs for the Chickahominy River watershed, which were completed in 2012. The area of interest in the developed TMDL included the entire free flowing segment of the Chickahominy River from headwaters to tidal limit at around river mile 24. This area encompasses two previously developed bacteria TMDLs in White Oak Swamp in Henrico County and Upham Brook in Henrico County/City of Richmond. Therefore, the implementation plan described in this report is considered a bacteria implementation plan for the two mentioned waterbodies as well. The TMDLs are posted at www.deq.virginia.gov. Water quality monitoring and the *E. coli* load reductions called for in the TMDL studies were reviewed to determine the water quality goals and associated pollutant reductions that would need to be addressed through the development of the implementation plan.

3.1 Water Quality Modeling

In order to understand the implications of the load allocations determined during TMDL development, it is important to understand the modeling methods used in the analysis. The United States Geological Survey (USGS) Hydrologic Simulation Program - Fortran (HSPF) water quality model was used as the modeling framework to simulate hydrology and existing conditions and perform *E. coli* bacteria TMDL allocations in the Chickahominy River and tributaries watershed. The model explicitly accounts for seasonal variations in hydrology, climatic conditions, and watershed activities. The model provides output every day over the simulation time period, allowing the *E. coli* geometric mean standard (126 cfu/100mL) to be used to calculate the TMDLs and percent reductions needed by source.

The project watershed was divided into 27 subwatersheds to facilitate the hydrology and bacterial modeling. **Figure 3.1** below shows the subwatershed numbering scheme within the project area. Subwatershed 26 represents Upham Brook while subwatershed 22 represents White Oak Swamp.

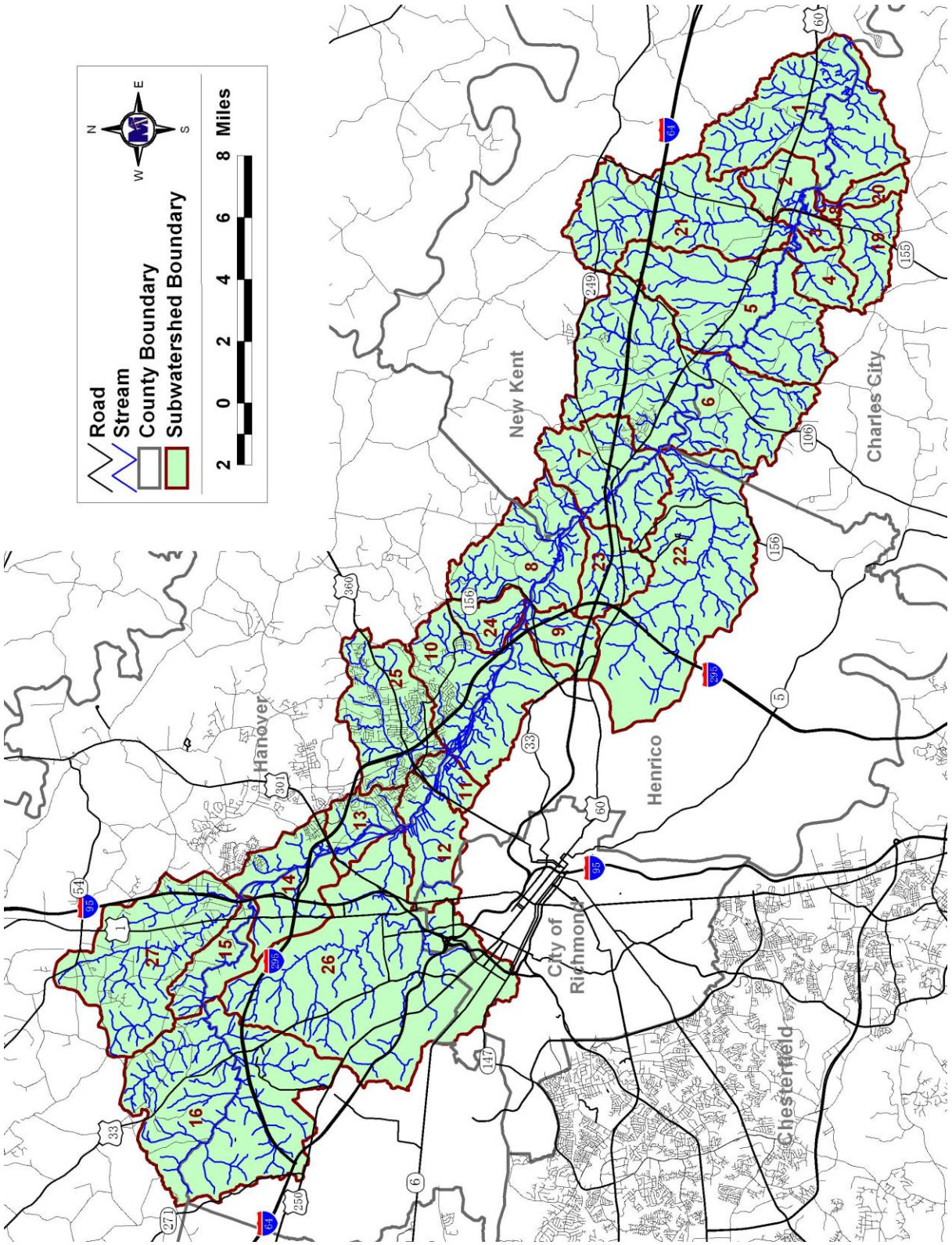

Figure 3.1 Subwatersheds used for modeling in the Chickahominy River TMDL project area.

3.1.1 *E. coli* Sources

Potential sources of *E. coli* considered in the TMDL development included both point source and nonpoint source contributions. The Virginia Pollutant Discharge Elimination System (VPDES) permitted point sources for fecal bacteria control are shown in **Table 3.1**.

Table 3.1 VPDES permitted point sources for fecal bacteria control in watershed.

Permit Number	Facility Name	Type	Permitted for EC	Design Flow (MGD)	Receiving Waterbody	Sub-watershed
VA0004031	Tyson Foods Incorporated - Glen Allen	Industrial	Yes	1.25	UT to Chickahominy River	16
VA0058041	Vulcan Construction Materials LP - Springfield	Industrial	No	1.22[1]	Chickahominy River	16
VA0061972	TravelCenters of America - Richmond Travel Center	Industrial	No	0.01[1]	UT to Lickinghole Creek	27
VA0090301	Richmond International Airport	Municipal	No	23.86[1]	White Oak Swamp	22
VAG250093	INGENCO - Charles City	General	No	0.01	UT to Chickahominy River	5

[1] Outfall includes storm flow and consequently the discharge volume varies with storm size.

At the time that this TMDL was created, permitted point discharges that may contain pathogens associated with fecal matter were required to maintain *E. coli* concentrations below 126 cfu/100 mL.

Both developed and rural nonpoint sources of *E. coli* bacteria were considered in water quality modeling. Sources included residential sewage treatment systems, land application of waste, livestock, wildlife, and domestic pets. Loads were represented either as land-based loads (where they were deposited on land and available for wash off during a rainfall event) or as direct loads (where they were directly deposited to the stream). Land-based nonpoint sources are represented as an accumulation of pollutants on land, where some portion is available for transport in runoff. The amount of accumulation and availability for transport vary with land use type and season. The model allows a maximum accumulation to be specified. The maximum accumulation was

adjusted seasonally to account for changes in die-off rates, which are dependent on temperature and moisture conditions. Some nonpoint sources, rather than being land-based, are represented as being deposited directly to the stream (*e.g.*, animal defecation in stream, straight pipes). These sources are modeled similarly to point sources, as they do not require a runoff event for delivery to the stream.

3.1.2 *E. coli* Model Allocations

Several model runs were made investigating scenarios that would meet the 30-day geometric mean goal of 126 cfu/100mL. The final bacteria reduction scenario is shown in **Table 3.2**. Final allocation scenario calls for a 100% reduction of direct human sources (straight pipes, sanitary sewer overflow (SSO), and non-permitted sewer overflows) as well as direct livestock contribution. A 77% reduction is needed from wildlife direct deposition. Reductions were also needed from developed lands (99%) and agricultural lands (99%) in addition to 77% reduction from wildlife land-based contribution.

Table 3.2 Final bacteria load reduction scenarios to meet the WQS for the study area.

Impairment	Wildlife Direct*	Wildlife Land Based*	Livestock Direct	Agricultural Land Based	Human Direct (Straight Pipes and SSOs)	Human and Pet Land Based
Chickahominy River watershed	77%	77%	100%	99%	100%	99%

*Direct and land-based wildlife bacteria reductions will not be explicitly addressed by this implementation plan (see Section 1.2.2)

3.2 Implications of the TMDL on Implementation Plan Development

The major implication in the development of these TMDLs is that considerable reductions are required to achieve the water quality standard. All uncontrolled discharges, failing septic systems and non-permitted overflows must be identified and corrected; livestock must be excluded from streams, and a majority of the residential nonpoint bacteria sources must be reduced. However, there are subtler implications as well. Implicit in the requirement for 100% correction of uncontrolled discharges is the need to maintain all functional septic systems and sewer lines. There is also the need to maintain currently installed livestock exclusion fencing.

While the wildlife bacteria reductions will not be explicitly addressed by this implementation plan, communities are encouraged to evaluate the presence of nuisance wildlife populations. For more information, see Section 1.2.2 in this report for additional resources on nuisance wildlife management planning.

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4. PUBLIC PARTICIPATION

Public participation was an integral part of the TMDL Implementation Plan development. Multiple meetings were held including public meetings, agricultural, residential, and government working groups in addition to a steering committee meeting. **Table 4.1** shows all the meeting dates, types, locations and attendance. Appendix A contains all of the meeting minutes from working groups and the steering committee.

Achieving the goals of this IP (*i.e.*, improving water quality and removing these waters from the Section 303(d) list) is dependent on stakeholder participation – not only the local citizens who need agricultural control measures or residential waste treatment facilities, but also all stakeholders within watershed. It must be acknowledged first that there is a water quality problem, and changes must be made as needed in operations, programs, and legislation to address these pollutants. Local citizens can become involved by picking up after their pets, properly maintaining their septic systems, properly handle the waste of their livestock, becoming water quality monitoring volunteers and volunteering to distribute information and educate others.

Table 4.1 Meetings held during the Chickahominy River TMDL IP development.

Date	Meeting Type	Location	Attendance
05/24/2012	First Public	Mechanicsville Branch Library	30
06/18/2012	First Government Working Group	Mechanicsville Branch Library	9
06/18/2012	First Residential Working Group	Mechanicsville Branch Library	6
06/26/2012	First Agricultural Working Group	Mechanicsville Branch Library	9
08/20/2012	Second Government/Residential Working Group	Piedmont Regional DEQ Office located at 4949-A Cox Road in Glen Allen VA 23236	13
08/20/2012	Second Agricultural Working Group	Piedmont Regional DEQ Office located at 4949-A Cox Road in Glen Allen VA 23236	7
11/27/2012	Steering Committee	Piedmont Regional DEQ Office located at 4949-A Cox Road in Glen Allen VA 23236	9
02/07/2013	Final Public meetings	Mechanicsville Branch Library	24

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5. ASSESSMENT OF IMPLEMENTATION BMPS

An important element of the TMDL IP is the encouragement of voluntary compliance with implementation actions by local, state, and federal government agencies, business owners, and private citizens. In order to encourage voluntary implementation, information was obtained on the types of actions and program options that can achieve the IP goals in a practical and cost-effective manner.

5.1 Identification of Control Measures

Potential control measures or best management practices (BMPs), their associated costs and efficiencies were identified through review of the TMDL, input from Working Groups, and literature review. Control measures were assessed based on cost, water quality impacts, and stakeholder interest. Measures that can be promoted through existing programs were identified, as well as those that are not currently supported by existing programs. Some control measures were indicated or implied by the TMDL allocations, while others were selected through a process of stakeholder review and analysis of effectiveness in these watersheds.

The bacteria removal efficiencies used in this study to quantify BMPs are listed in **Table 5.1**. The control measures listed in Table 5.1 are divided into categories based on the method of load reduction. "Direct Reductions" are those that reduce the load of pollutant from a specific source to the stream itself or to the land. "Buffer" practices control pollutants through both land conversion and treatment of runoff from upland areas. "Runoff Treatment" measures are those that either capture and treat runoff (*e.g.*, retention ponds) or call for changes in land management, which alters the runoff potential of the land (*e.g.*, improved pasture management).

The BMP bacteria removal efficiencies shown in Table 5.1 are based on the experiments performed as noted in the applicable reference. It is understood that BMP performance varies based on storm events, climates, collection methods, laboratory methods and protocols, and various other factors, which leads to uncertainty in the results.

Table 5.1 Potential control measure efficiencies in removing bacteria.

Control Measure	Bacteria Removal Efficiency Value or Range Cited	Efficiency Used in IP Model	Reference
Direct Reduction Efficiency			
Streamside Fencing	100%	100%	1
Corrected Straight-pipe	100%	100%	1
Repaired Septic System	100%	100%	1
Pet Waste Pick-Up Program	50%	50%	3
Pet Waste Composters	99%	99%	1
Buffer Efficiency*			
Vegetated Buffer	94% - 99.9%	100% for buffer itself and 50% for an adjacent area that equals double the buffer area	6
Runoff Treatment Efficiency			
Improved Pasture Management	50%	50%	4
Rain Garden	70%	70%	5
Bioretention Basin	90%	90%	4
Retention Pond	70%	70%	4
Conservation Tillage	61%	61%	2,7

*Buffer efficiencies shown here apply to runoff generated outside of the buffer area, but within a distance equal to twice the buffer width. Additional reductions result from the conversion of land from its existing condition to the buffer area.

1 Removal efficiency is defined by the practice.

2 Commonwealth of Virginia. 2005. Chesapeake Bay Nutrient and Sediment Reduction Tributary Strategy for the James River, Lynnhaven, and Poquoson Coastal Basins. http://www.richmondregional.org/Publications/Reports_and_Documents/Planning/2005_james_river_tributary_strategy.pdf (Number of sampling events is not provided by the source.)

3 Residential Working Group discussions after review of pet waste pick-up behaviors in multiple surveys.

4 Hunt, W.F., J.T. Smith, and J.M. Hathaway. 2007. Nutrient, Metal, and bacteria removal by an urban bioretention area in Charlotte, NC. Journal of Environmental Engineering. (Number of sampling events is not provided by the source.)

5 Hunt, William F, Jonathan T Smith, and Jon Hathaway. City of Charlotte Pilot BMP Monitoring Program , Mal Marshall Bioretention Final Monitoring Report. City of Charlotte, 2007. (33 sampling events)

6 Tate, K. W., Atwill, E. R., Bartolome, J. W. & Nader, G. 2006 Significant Escherichia coli attenuation by vegetative buffers on annual grasslands. J. Environ. Qual. 35, 795–805. (27 sampling events on 48 plots)

7 Bacteria removal efficiency estimated based on sediment and nutrient removal efficiency.

It is recognized that there are BMPs not listed in Table 5.1 above that would have a positive impact on the water quality of the Chickahominy River and tributaries. It is difficult to model

the bacteria load reductions and the changes to hydrology that result from the installation of some BMPs. It is uncertain how to quantify bacteria removal and runoff retention of a BMP if bacteria removal efficiencies or hydrologic changes are unknown. For example, it is unknown how planting a tree will reduce the bacteria in a nearby stream; however, based on common knowledge, urban tree planting can enhance the environment by increasing shade, increasing transpiration, contributing to the beautification of a city, and benefiting air quality. Also some education practices were difficult to quantify, but would be beneficial additions to a Pet Waste Pick-up Program (explained more in Section 5.3.3). Therefore, based on Working Group members' suggestions, the BMPs in **Table 5.2** should be promoted in the watershed as "Green Practices" that will benefit the surrounding environment

The 'Difficulty of Installation/ Implementation' column was determined by working group members in previous IPs and best professional judgment using knowledge of costs, ease of installation, amount of maintenance needed, and engineering/design requirements.

Table 5.2 BMPs to promote in the Chickahominy River watershed.

Practice	Difficulty of Installation/ Implementation	Direct Waste or Land Use Treated
Agricultural BMPs:		
Equipment Rental to Improve Pasture Conditions	Easy	Pasture
Geese Over-population BMPs:		
Nuisance Wildlife Management Plan	Easy	Geese waste
Residential/Urban BMPs:		
Urban Trees	Easy	Residential/Commercial
Upland Reforestation	Easy	Residential/Commercial
Bayscape	Medium	Residential/Commercial
French Drain	Medium	Residential
Dry Well	Medium	Residential
Level Spreader	Medium	Commercial
Rain Barrels	Easy	Residential/Commercial
Dry Swale	Medium	Commercial
Wet Swale	Medium	Commercial
Filtering Practices	Medium	Residential/Commercial
Grass Channels	Easy	Residential/Commercial
Constructed Wetlands	Difficult	Residential/Commercial
Confined K-9 Septic System	Medium / Difficult	Residential/Commercial
Any Low Impact Development (LID) Practices	Medium / Difficult	Residential/Commercial in Non-CSO watersheds
Other Innovative Projects	Easy/ Medium	Any

5.2 Currently Installed BMPs

In an implementation plan it is important to acknowledge, and take into account, the BMPs and programs already in place that treat or prevent the pollutant of interest from reaching surface waters. In the Chickahominy River watershed, BMPs currently installed that treat or prevent bacteria from traveling to surface waters include: streamside fencing BMPs, failing septic repairs, pet waste pick-up stations, residential stormwater ponds, and riparian buffers. There are also many Low Impact Development (LID) control measures already installed within the watershed. This section will highlight each of these accomplishments. These BMPs will be taken into account in the "Quantification of Control Measures" section as necessary.

The following description is not intended as a complete list of every measure that has taken place within the watershed but is rather intended to highlight efforts and achievements within the study area.

When similar measures to those proposed in the implementation plan have already been implemented, they should be taken into consideration when the proposed measures are quantified. This process is governed by two criteria. First, the amount of the proposed measure should not exceed the available amount minus the existing amount. For example, if the watershed contains 10,000 acres of cropland, the available portion that can be transferred into conservation tillage is not the entire 10,000 acres but rather the amount that is in conventional tillage. Another example where the summation of existing and proposed measures should not exceed the available amount is streamside fencing. The TMDL calls for 100% elimination of livestock access to streams by installing an estimated 128,000 feet of fencing. However, approximately 3,000 ft of fencing have already been installed which leaves 125,000 ft of fencing to be installed. The second criterion deals with timing of implementation in relation to the simulated timeframe of existing condition within the study area. For example, if the implementation plan recommends fixing 35 straight pipes that were estimated at existing conditions (in this case, this would be the 2012 estimates), but 5 straight pipes have been fixed since then, the recommended number of straight pipes for fixing should be 30 rather than 35.

It is important to keep in mind that proposed amounts of various measures are just best estimates and are not intended to be viewed as exact numbers. The issue of accounting for existing

measures becomes less of a burden to deal with when we take into consideration that the implementation is an interactive process where actual identification of the applicable amount of a certain measure is quantified on the ground on an as-needed basis. Moreover, implementation takes place in phases and measures that are not needed will not be implemented.

Agricultural BMPs Already Installed

It is recognized that the Soil and Water Conservation Districts (SWCD) and Natural Resources Conservation Service (NRCS) have been working in these watersheds to establish agricultural Best Management Practices (BMPs) that are both cost-effective and beneficial to the farmer and the environment. Counties, localities, and government agencies have also been implementing measures to combat straight pipes, failing septic systems, and sanitary sewer overflows. The information in **Table 5.3** was derived from the Department of Conservation and Recreation (DCR) Ag BMP database (http://192.206.31.46/cfprog/dswc/bmpprm.cfm). Of all the BMPs in the database, those shown in Table 5.3 are the most efficient at (or contribute to) prevention/removal of bacteria from agricultural land runoff. Hanover County installed sedimentation retention basins draining roughly 5,000 acres of developed lands. While such basins are tailored towards trapping sediment, they also contribute to reducing amount of fecal bacteria reaching water bodies.

Table 5.3 Currently installed Agricultural BMPs within the study area that prevent/remove bacteria.

BMP name	DCR BMP Code	Units	# Units Installed
Continuous No-till System	SL-15A	Acres	1,516
Long-term Continuous No-till System	CCI-CNT	Acres	1,945
Grass Filter Strips	WQ-1	Acres	3
Grazing Land Protection	SL-6	Lin. Feet	3,235
Harvestable Cover Crops	SL-8H	Acres	110
Permanent Veg. Cover on Cropland	SL-1	Acres	217
Protective Cover for Specialty Crops	SL-8	Acres	156
Reforest. of Erodible Crop/Pasture	FR-1	Acres	2

Existing Pet Waste Programs

Localities within the study area have implemented varying degrees of Dog Waste Pick-Up programs. The City or Richmond developed a program in the fall of 2010. Hanover County has a dispenser program for bags and seeks volunteers (Pooch Pals) to check dispensers regularly and keep a count of how many bags are used. A brochure developed by the county explains the impact of pet waste on water quality along with tips on how to deal with dog waste. Hanover County has distributed 40 pet waste composters in the past.

Street Sweeping

Pollutants that potentially can enter surface water through storm sewers, including sediment, debris, trash, road salt, chemicals, and trace metals can be minimized by street sweeping. Recent estimates are that the new vacuum assisted dry sweepers may achieve 50-88% overall reduction in the annual sediment loading from a residential street, depending on sweeping frequency (Bannerman, 1999). A benefit of high-efficiency street sweeping is that they capture pollutants before they are made soluble by rainwater (http://www.stormwatercenter.net/Pollution_Prevention_Factsheets/ParkingLotandStreetCleaning.htm). Street sweepers also make road surfaces less slippery in light rains, improve aesthetics by removing litter, and prevent clogging of inlets from leaves and debris. Street sweeping has the potential of removing bacteria that is attached to sediment, that has traveled to road ways via runoff, and from dog waste from urban pets and wildlife. Effective sweeping schedules (3 times per year: spring, summer, fall) and routine sweeper maintenance are suggested to optimize the efficiency of the practice at removing possible pollutants.

Henrico County plans to sweep an average of 5,000 lane miles per year. Of this total, approximately 2,350 lane miles are within the Chickahominy River watershed

5.3 Quantification of Control Measures

5.3.1 Agricultural BMPs

The allocations determined during the TMDL development dictate some of the control measures that should be employed during implementation. In order to meet the reductions in direct deposition from livestock, some form of stream exclusion is necessary. Fencing is the most

obvious choice; however, the type of fencing, distance from the stream bank, and most appropriate management strategy for the fenced pasture are less obvious.

While it is recognized that farmers will want to minimize the cost of fencing and the amount of pasture lost, any fencing installed through the use of cost-share programs should follow established NRCS specifications and be located 35-ft from the stream bank, at a minimum, as is specified in existing Virginia cost-share programs.

An alternative water source will typically be required where pasture is fenced off from streams. The main criterion is that the system be dependable. Water systems alone (*i.e.*, with no streamside fencing) have been shown to reduce the amount of time cattle spend in the stream by as much as 50 to 80%. This is not a large enough reduction to meet the TMDL. It is recommended that all fencing, even that which is installed solely at the landowner's expense, be placed at least 35-ft from the stream. The inclusion of a buffer helps to reduce bacteria as well as sediment and nutrient loads in runoff. The incorporation of effective buffers could reduce the need for more costly control measures.

From an environmental perspective, the best management scenario would be to exclude livestock from the stream bank 100% of the time and establish permanent vegetation in the buffer area. This prevents livestock from eroding the stream bank, provides a buffer for capturing pollutants in runoff from the pasture, and establishes (with the growth of streamside vegetation) one of the foundations for healthy aquatic life. From a livestock-production perspective, the best management scenario is one that provides the greatest profit to the farmer. Obviously, taking land (even a small amount) out of production is contrary to that goal. However, a clean water source has been shown to improve milk production and weight gain. Clean water will also improve the health of animals (*e.g.*, cattle and horses) by decreasing the incidence of waterborne illnesses and exposure to swampy areas near streams. Additionally, intensive pasture management, which becomes possible with an alternative water source, has been shown to improve overall farm profitability and reduce environmental impact. From a part-time farmer's perspective, the best management scenario is one that requires minimal input of time. This would seem to preclude intensive pasture management; however, those farmers who have adopted an intensive pasture-management system typically report that the additional

management of the established system amounts to "opening a gate and getting out of the way" every couple of days. Additionally, the efficient use of the pasture often means that fewer supplemental feedings are necessary. Among both part-time and full-time farmers there are individuals who are hesitant to allow streamside vegetation to grow unrestricted because of aesthetic preferences or because they have spent a lifetime preventing this growth. However, given the reductions needed in pollutant (*i.e.*, fecal bacteria) delivery to the stream, a vegetated buffer will be needed. For planning purposes, it was assumed that a vegetated buffer would be established in conjunction with stream fencing.

5.3.1.1 *Livestock Exclusion BMPs*

To estimate fencing requirements, the stream network was overlaid with land use (2006 NLCD). Stream segments that flowed through or adjacent to land use areas that had a potential for supporting cattle (pasture) were identified. If the stream segment flowed through the pasture area, it was assumed that fencing was required on both sides of the stream, while if a stream segment flowed along the edge of the pasture area; it was assumed that fencing was required on only one side of the stream. The fencing segments identified were checked against aerial photography and stream layer of the watershed and adjustments (increasing or decreasing) were made on a site by site basis in cases were the land use/land cover layer misclassified the pasture lands. This resulted in considerable reduction of stream length available from the initial estimate. Stakeholders confirmed however, that the revised estimate derived from aerial photography verification of “pasture” land use provided a stream length more realistic than the initial estimate. Not every land-use area identified as pasture has livestock on it at any given point in time. However, it was assumed that all pasture areas have the potential for livestock access.

The Chickahominy River watershed contains an estimated 1,861 horses which is larger in number and waste production than cattle within the same watershed. It was concluded during IP agricultural working group discussions that some, albeit small, percentage of all horses may have access to streams. However, due to the large number of horses, it was assumed that half the identified fencing length would be installed to exclude horses while the other half would be installed to exclude cattle from streams. It was agreed that fencing of horses would not be

covered under cost-share programs, unless the owner can indicate horses are operated within a farm business.

Also as a result of agricultural working group meetings, it was determined than the cattle fencing supported by cost-share programs would be limited to that on identified perennial streams and intermittent streams in cases that are considered critical or as deemed appropriate by the SWCDs. It was recognized that cattle access to intermitted streams contributes to the problem and therefore, the length of fencing estimated to be along intermittent streams was calculated. The portion of fencing along perennial streams was estimated at 30% of total fencing while the remaining 70% was estimated to be along intermittent streams. A map of all potential streamside fencing required for the Chickahominy River watershed is shown in **Figure 5.1**. An estimate of 127,695 feet of streamside fence required to exclude livestock from the streams was calculated for the watershed areas that required direct livestock reductions in the TMDL.

The stream segments intersecting pasture lands that were digitized earlier to improve the accuracy of estimated potential fencing length were visually grouped into 118 potential fencing systems. The average length of fencing per system was estimated at approximately 1,100 ft. The VADCR Agricultural BMP Database was utilized to determine the length of fencing already installed within the watershed. Approximately 3,200 ft of fencing were reported at the time this report was drafted.

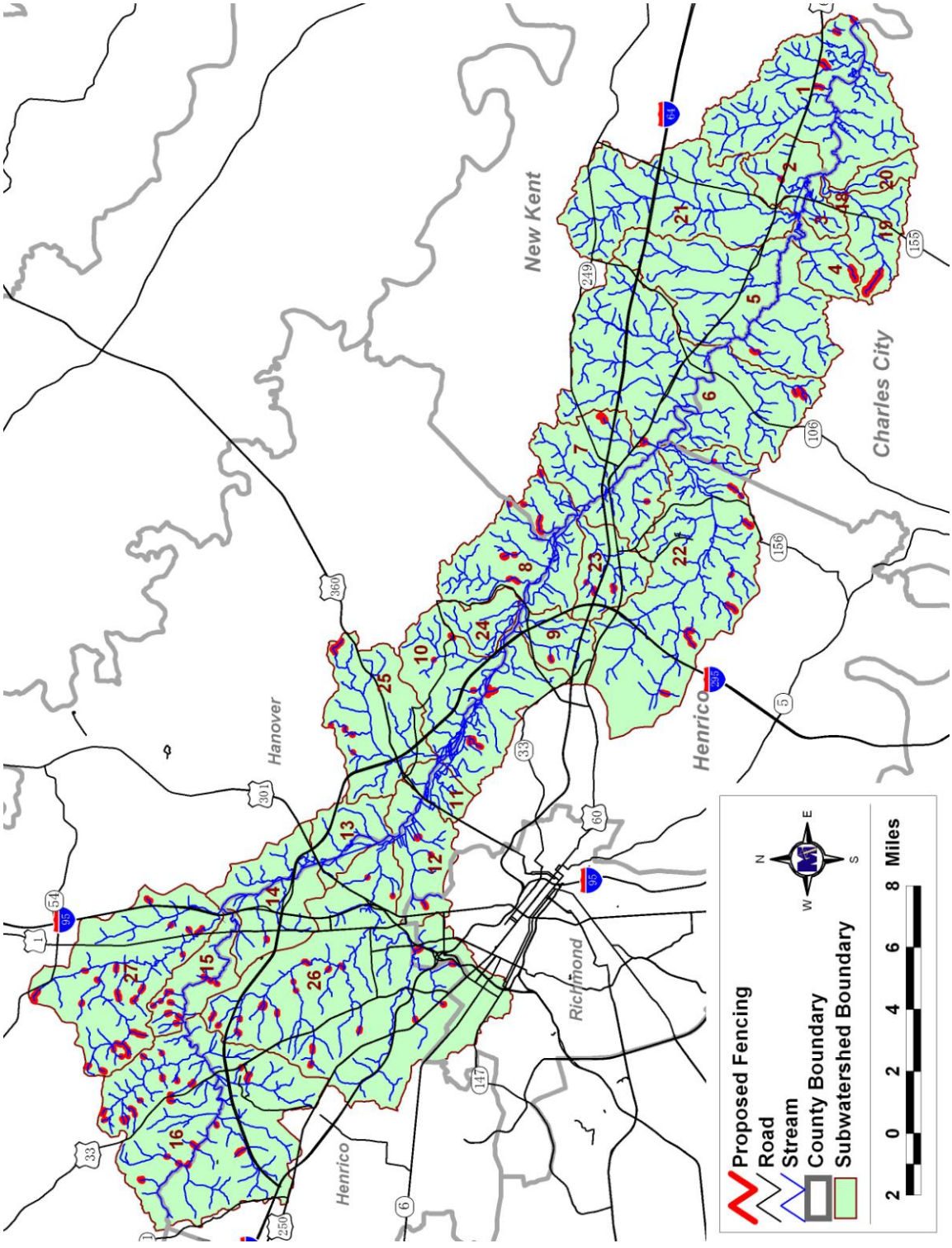

Figure 5.1 Proposed fencing locations.

Livestock exclusion systems identified for this project include:

- The Livestock Exclusion with Riparian Buffer (SL-6 and LE-1T) systems include streamside fencing, interior fencing, alternative watering system, and require a 35-ft buffer from the stream. The SL-6 practice offers a cost-share up to 75%, whereas the LE-1T practice offers a maximum of 85% and can only be installed in a TMDL IP watershed.
- The Stream Protection (WP-2T) system includes streamside fencing, hardened access/crossing options, requires a 35-ft buffer, and offers a 75% cost-share, and can only be installed in a TMDL IP watershed. In cases where a watering system already exists, a WP-2T system is a more appropriate choice.
- Cattle Systems on intermittent streams that are accessed by cattle
- Non-Cost share Horse Systems are where horses have access to streams

The streamside fencing estimates were updated to exclude the fencing already installed in the watershed. **Table 5.4** summarizes fencing needs. To establish the total number of full livestock exclusion systems necessary to achieve full implementation, systems were calculated by dividing the total needed length of streamside fencing by the average streamside fencing length per system (1,100 ft). Half of the needed fencing is estimated to go towards horse fencing which results in 58 systems. Seventy percent of the remaining half is assumed to be fencing on intermittent streams. The remaining 30% of the length of needed fencing is partitioned among fencing that already exists, LE-1T systems, and WP-2T systems. Cost-share fencing on intermittent streams will be decided on a case-by-case basis. Horse owners can qualify for cost-share for stream exclusion is if they are considered a farming business and have >$1000 in receipts as proof.

Table 5.4 Needed and existing streamside fencing to exclude livestock in the study area.

Estimated Fence Length Needed	127,695 ft	
Estimated Fence Length Per system	1,100 ft	
Horse Fencing ~ (0.5 * 127695 / 1100)	63,848 ft 58 systems	
Cattle fencing on intermittent streams ~ (0.5 * 0.7 * 127695 / 1100)	44,693 ft 41 systems	
Cattle fencing on perennial streams ~ (0.5 * 0.3 * 127695 / 1100)	19,154 ft (**18** systems)	**3** systems already exist
		2 WP-2T systems
		13 LE-1T systems

As is typical in agricultural components of IPs (recommended by DCR), 7% (8,939 feet) of all fencing length installed would need to be replaced during the length of the project.

The estimated needed fencing length by subwatershed is shown in **Table 5.5.** The lengths shown in the table are obtained by the amount of pasture acreage intersecting streams.

Table 5.5 Streamside fencing length by subwatershed in the study area.

Sub-watershed	Fencing length (ft)
1	4,926
2	516
4	4,776
5	1,258
6	5,270
7	3,201
8	6,768
9	1,005
10	7,612
12	3,126
13	10
14	384
15	6,357
16	18,128
19	9,890
22	13,333
23	1,812
25	4,705
26	12,204
27	22,414
Total	**127,695**

5.3.1.2 Land-Based BMPs

In addition to direct livestock bacteria reductions, agricultural land-based bacteria reductions are also needed in the watershed. One BMP identified was improved pasture management (Prescribed Grazing Plan and Implementation (NRCS 528)). This BMP is considered an enhancement of a Livestock Exclusion system. Along with the infrastructure provided by a

grazing land management system, improved pasture management can include the following to be beneficial to reducing erosion and bacteria attached to sediment:

- Maintenance of an adequate forage height (suggested 3-inch minimum grass height) during growing season.
- Application of lime and fertilizer according to soil test results.
- Mowing of pastures to control woody vegetation.
- Distribution of manure through managed rotational grazing.
- Reseeding due to severe drought if necessary.

All agricultural land-based BMPs in **Table 5.6** should be implemented to meet the target bacteria load. The stage of the IP that each BMP will be placed in is noted in Table 5.6.

Vegetated buffers were also included in the implementation strategy to filter runoff from cropland. These buffers will act as filters, trapping bacteria and sediment before it runs into the stream. When considering the effectiveness of a vegetated buffer in trapping pollutants, it is important to consider the area that will be draining to the buffer. Based on best professional judgment and for modeling purposes, it was assumed that a typical buffer would be capable of receiving and treating runoff from an area three times its width times length. This limitation is placed in order to account for loss of trapping efficiency when flow becomes concentrated rather than sheet flow.

Table 5.6 Agricultural land-based BMPs for the study area.

Control Measure	Unit	Amount	Stage of Project
Improved Pasture Management (NRCS 528)	Acres	23,245	Stage I/II
Conservation Tillage – Crop (SL-15A)	Acre	419	Stage I
Waste Storage/Composting/ Education - Horse	System	190	Stage I/II
Retention Ponds - Cropland	Acre treated	3,000	Stage II
Retention Ponds - Pasture	Acre treated	13,850	Stage II
Riparian Buffers - Cropland	feet	20,000	Stage I/II

5.3.2 Residential Waste Treatment BMPs

The allocations determined during the TMDL development dictate some of the control measures that should be employed during implementation. The 100% reduction in bacteria loads from

straight pipes, failing septic systems, and non-permitted sewer overflows is a pre-existing legal requirement as well as a result of the TMDL. This reduction indicates that all illicit discharges (*i.e.*, straight pipes and cross-connections) in the watersheds should be corrected, and that all onsite sewage treatment systems (*e.g.*, septic systems and alternative waste treatment systems) and sewer infrastructure should be maintained in proper working condition. The local VDH is the regulatory agency in charge of septic system and alternative system maintenance (Section 7.6.5). Stream walks, watershed tours, home-to-home surveys, citizen monitoring, and public education are possible ways to improve the current method of straight pipe, failing septic system, and leaking sewer system identification. The options identified for correcting illicit discharges and failing septic systems included: repair of an existing septic system, installation of a septic system, installation of an alternative waste treatment system, and sewer hook-up. Correction of sewer overflows and leaks is an ongoing effort of the entities charged with the maintenance and operation of these systems.

All straight pipes and failing septic systems should be identified and corrected during implementation since a 100% load reduction from these sources was deemed necessary to meet the TMDL goals.

The number of houses with septic systems was estimated by subwatershed using census data. The number of failing septic systems was estimated based on the assumption that each septic systems fails, on average, once during an expected lifetime of 30 years. The initial estimates obtained using this method were revised by conferring with data from counties detailing the locations of septic systems and public sewer connections. Resulting estimates were shared with regions Health Departments and feedback was obtained and used in adjusting numbers. Comments from multiple districts were incorporated and the initial estimates were generally reduced. In the case of straight pipes, the estimates were reduced considerably. **Table 5.7** shows the number of failing septic systems and straight pipes estimated for each subwatershed from the TMDL.

Table 5.7 Estimated residential waste treatment systems by sub-watershed.

Sub-watershed	Estimated Homes with Failing Septic Systems	Estimated Homes with Straight Pipes
1	11	1
2	2	0
3	1	0
4	3	0
5	16	2
6	60	2
7	37	1
8	13	0
9	3	0
10	30	1
11	1	0
12	2	1
13	5	0
14	8	1
15	14	2
16	40	3
17	0	0
18	0	0
19	5	0
20	1	0
21	9	0
22	6	6
23	1	1
24	5	0
25	39	3
26	45	6
27	30	5
Total	**387**	**35**

It was assumed that 25% of the failing septic systems would need to be replaced. Fifteen percent of failing septic systems were assumed to be repairable. The remaining 60% (230 out of 387) of failing septic systems would be corrected by connecting to the sewer network. As for straight pipes, it was assumed that half would be fixed by installing a septic system. Ninety percent of the remaining straight pipes would be fixed by connecting to the sewer network with the remaining straight pipes fixed by installing an alternative waste treatment system.

The conservative sewer connection cost estimates were vetted by stakeholders and reflect some of the additional infrastructure costs which may be necessary such as sewer mains and lateral

lines. Each connection cost may vary based on unique property factors such as elevation, geology, and distance of a property to existing sewer main

The numbers of septic tank pump-outs in the Plan were estimated by assuming 90% compliance within Henrico County and 40% compliance within Hanover County. Compliance within New Kent and Charles City counties was assumed at 50% (**Table 5.8**).

All septic systems repairs, new septic systems, sewer connections, and alternative systems BMPs were placed in Stage I of the plans. The estimated septic pump-outs were placed in Stage I and Stage II according to VADEQ feedback.

Table 5.8 Estimated residential waste treatment system BMPs needed in the study area.

County	Estimated Sewer Connections Needed	Estimated Septic Systems Repairs Needed	Estimated New Septic Systems Needed	Estimated Alternative Waste Treatment Systems Needed	Annual Septic System Pump-Outs Needed*
Henrico	58	22	21	1	51
Hanover	98	41	29	1	561
New Kent	55	23	16		270
Charles City	34	14	9		165
Total	**245**	**100**	**75**	**2**	**1,047**

* Needed above and beyond the normal expected compliance rate.

5.3.3 Pet Waste Pick-up Program

The final TMDL reduction scenario (**Table 3.2**) required high reductions to residential land-based bacteria loads. Other than wildlife loads, the residential land use accumulates bacteria loads from human sources from failing septic systems (addressed in Section 5.3.2) and from domestic pets (dogs). Therefore, a pet waste pick-up program, or Community Pet Waste Education Program, is recommended to address dog waste in the project watershed. The Community Pet Waste Education Program was placed throughout Stage I and Stage II as it would be an on-going program.

There are several parks / dog parks in the project watershed: I-64 MM 213 E&W Rest Stops, Echo Lake County Park (Henrico Co.), Laurel Recreational Area (Laurel), North Run Park

(Glenn Allen), Bryan Park (Richmond), North Side Dog Park (Richmond), Vawter Street Park (Henrico Co.), Quinton Community Park (New Kent Co.). These and other parks should be inventoried for pet waste stations to ensure that users of the parks have the necessary amenities to clean up after their dogs.

Pet waste stations should be installed in parks to encourage people to clean up after their pets. The education program may also include a combination of educational materials distributed to pet owners, signage describing water quality concerns related to pet waste, and disposal bags and receptacles in areas of high pet traffic. Consideration should also be given to distributing pet waste information at camp grounds, picnic areas, school recreation spaces, community centers, "pocket parks" within the city, and tourist attractions. All future parks established within the watershed should have pet waste needs managed appropriately.

Education to Vet Clinics, SPCAs, Pounds, Shelters, and Hunt Clubs could be accomplished by giving these establishments educational materials that they could distribute to clients and post in their lobby/common area, as well as educating the caretakers of these establishments in the proper practices in pet waste cleanup for their kennels. Establishments that wash off dog kennels could install septic systems with retro-fit filters to prevent hair clogs.

Municipalities could enact an ordinance to require proper disposal of pet waste and could gain income if it includes fines to people who do not pick up after their pet in common areas. The City of Richmond's code states: "Pet waste shall be disposed of as solid waste or sanitary sewage in a timely manner, to prevent the discharge thereof to the municipal separate storm sewer or waters of the state".

An additional Pet Waste Composter program is also proposed to help eliminate pet waste in homeowner's private yards and kennels. The program includes the distribution of pet waste composters to households with pets. The pet waste composter idea was not as readily accepted by the working groups; therefore, pet waste composters were placed in Stage II of the plan.

5.3.4 Residential BMPs

Dog waste is the predominate source of bacteria in a residential landscape once all failing septic systems, straight pipes, sewer leaks, and non-permitted sewer overflows are corrected. However,

the documented bacteria removal efficiency of a pet waste pick-up program is not enough reduction to meet the TMDL bacteria goals for most of the impaired stream segments. Therefore, other BMPs were needed that treat runoff and remove bacteria from runoff waters.

The quantification of residential BMPs to reduce bacteria in stormwater runoff was limited by the bacterial removal efficiency information available (Table 5.1) and by using the acreages of Developed land uses as the maximum extent that each BMP could be installed in the watersheds. Due to these constraints, four residential BMPs were quantified: Retention Ponds, Rain Gardens, Bioretention Facilities, and Vegetated Buffers. All residential/urban BMPs in **Table 5.9** should be implemented to meet the target bacteria load in the watershed.

These BMPs were placed in both stages on Implementation. Retention ponds were all placed in Stage II. Rain Gardens and vegetated buffers were split in half between Stages I and II. As for bioretention facilities, 25% were placed in Stage I and the remaining 75% were placed in Stage II.

Table 5.9 Residential BMPs (acres-treated) recommended to treat bacteria in runoff.

Retention Ponds (acre-treated)	Rain Gardens (acre-treated)	Bioretention Facilities (acre-treated)	Vegetated Buffers (ft)
5,000	500	200	20,000

5.4 Technical Assistance and Education

Stakeholders agree that technical assistance and education is key to getting people involved in implementation. There must be a proactive approach to contact farmers, horse owners, and residents to articulate exactly what the TMDL means to them and what practices will help meet the goal of improved water quality. The working groups recommended several education/outreach techniques, which could utilized during implementation. Outreach at County Fairs has been successful in other watersheds in the past. There are also opportunities for joint events with the Virginia Cooperative Extension Service. It may also be possible to involve the local Ruritan and Rotary clubs. A program should be established to educate septic and alternative waste system installers on the maintenance requirements expected of the homeowner. Many waste system installers are not aware of the maintenance required. In addition a Pet Waste Education program needs to be developed to educate pet owners about the importance of picking

up after their dogs to protect water quality. This is in addition to a residential educational programs with multiple workshops per year and an educational program for horse owners on proper handling of horse waste.

The following tasks associated with agricultural and residential programs were identified:

Agricultural Programs

1. Make contact with landowners in the watershed to make them aware of implementation goals, cost-share assistance, and voluntary options that are beneficial.
2. Provide technical assistance for agricultural programs (*e.g.*, survey, design, layout, and approval of installation).
3. Develop educational materials & programs.
4. Organize educational programs (*e.g.*, County Fair, presentations at joint VCE events or club events).
5. Distribute educational materials (*e.g.,* informational articles in FSA or Farm Bureau newsletters, local media).
6. Handle and track cost-share.
7. Assess and track progress toward BMP implementation goals.
8. Coordinate use of existing agricultural programs and suggest modifications where necessary.

Residential Programs

1. Identify straight-pipes and failing septic systems (*e.g.*, contact landowners in older homes, septic pump-out program).
2. Handle and track cost-share.
3. Develop educational materials & programs.
4. Organize educational programs (*e.g.*, demonstration septic pump-outs, nutrient management, pet waste control).
5. Distribute educational materials (*e.g.*, informational pamphlets on TMDL IP and on-site sewage disposal systems).
6. Assess progress toward implementation goals.

Staffing needs were quantified using full time equivalents (FTE), with one FTE being equal to one full-time staff member. It was determined that one FTE would be needed for each SWCD in the study area to provide technical assistance in the watersheds for the first five years of implementation (Stage I). The same positions would continue for Stage II in the event that Stage II measures would be needed. The FTEs would address both residential and agricultural BMPs and therefore, their time is divided between the two types of practices.

5.5 Cost Analysis

5.5.1 Agricultural BMPs

Streamside fencing through or adjacent to pasture with potential livestock access was translated and quantified into full livestock exclusion systems as described in Section 5.3.1.1. The cost of an LE-1T system was estimated at $15,000 and the cost of a WP-2T system was estimated at $8,000.

The cost of fence maintenance was identified as a deterrent to participation. Financial assistance possibilities for maintaining fences include an annual 25% tax credit for fence maintenance and conservation easements where the landowner is paid a percentage of the land value to leave it undisturbed. Additionally, the Streambank Protection (WP-2T) cost-share practice will be available as part of the implementation project and provides an upfront incentive payment to maintain stream fencing. The cost per foot for streamside fence maintenance is estimated at $3.50/ft.

The remaining costs outlined in **Table 5.10** were determined through literature review, analysis of the Virginia Agricultural BMP Database, and discussion with stakeholders and working group members. The $21,000 listed in the Waste Storage/Composting/Education – Horse measure is to cover the educational component of the program. This includes educational website development and maintenance, educational flyers and mailings, workshops, and signage for public park access points. Funding will be shared by each of the three SWCDs.

Table 5.10 Agricultural BMP costs for full implementation.

Agricultural BMPs	Unit	Cost per Unit	Total Units	Total Cost
Livestock Exclusion with Riparian Buffer (LE-1T)	System	$15,000	13	$195,000
Stream Protection (WP-2T)	System	$8,000	2	$16,000
Cattle Fencing on Intermittent Stream	System	$15,000	41	$615,000
Non-cost-share Horse Fencing	System	$30,000	58	$1,740,000
Improved Pasture Management (NRCS 528)	Acre	$150	23,245	$3,486,750
Conservation Tillage – Cropland (SL-15A)	Acre	$100	419	$41,900
Riparian Buffers – Cropland	Feet	$1	20,000	$20,000
Retention Ponds - Cropland	Acre-Treated	$200	3,000	$600,000
Retention Ponds - Pasture	Acre-Treated	$200	13,850	$2,770,000
Streamside Fence Maintenance	Feet	$3.50	8,939	$31,287
Waste Storage/Composting/Education – Horse	System	$3,000 per system + $21,500 fixed cost	190	$591,500
Total				**$10,107,437**

5.5.2 Residential Waste Treatment BMPs

The costs outlined in **Table 5.11** were determined through past IP projects and discussion with stakeholders and residential working group members.

Table 5.11 Residential Waste Treatment BMPs costs for full implementation.

Residential Waste Treatment BMPs	Unit	Cost per Unit	Total Units	Total cost
Septic Systems Pump-outs (RB-1)	System	$450	10,468	$4,710,600
Septic System Repair (RB-3)	System	$3,500	100	$350,000
Septic System Installation/Replacement (RB-4)	System	$8,000	75	$600,000
Alternative Waste Treatment System Installation (RB-5)	System	$20,000	2	$40,000
Sewer Connection	System	$32,000	245	$7,840,000
Total				**$13,540,600**

5.5.3 Residential Education Program

A Resident Watershed Educational Workshop program was a working group BMP identified to provide four workshops for area residents, booklet and educational materials for attendees, and

newspaper notices to advertise workshops. The workshops would teach homeowners about the BMPs they could install on their own properties, proper lawn management, stormwater management, pet waste management, resident goose management planning and human techniques for reducing their impacts to water quality, septic/sewer owner tips and maintenance, as well as teaching water quality basics and introduce them to citizen monitoring in the watershed. The expected cost of the program is a modest $2,300 per year for a total of $11,500 for the five years in Stage I.

5.5.4 Pet Waste Pick-up Program

The costs outlined in **Table 5.12** were determined through online cost references and feedback from working group members. The number of mailings was based on the number of housing units within the study area. As the aspects of the educational component of the pet waste pick-up program unfold, it is anticipated that the total cost of the program will be greater than the total shown in Table 5.12.

Table 5.12 Pet Waste Pick-up Program initial costs for full implementation.

Pet Waste Pick-up Program	Unit	Cost per Unit	Total Units	Total cost
Baggy, Sign and Waste Basket Station	Station	$170	50	$8,500
Bag Refills	Each	$0.10	1,940,755	$194,076
Mailings	Each	$0.42	102,145	$42,901
Pet Waste Composters	Each	$50	2,510	$125,500
Total				**$370,976**

5.5.5 Additional Residential BMPs

The costs outlined in **Table 5.13** were determined from the Pollutant Removal Performance Database version 3, Appendix E (http://archive.constantcontact.com/fs045/1101639006674/archive/1101831552482.html) and feedback from residential working group.

Table 5.13 Residential/Urban BMP costs for full implementation.

Residential/Urban BMPs	Unit	Cost per Unit	Total Units	Total Cost
Retention Ponds – Mixed (pervious and impervious)	Acre-Treated	$1,356	5,000	$6,780,000
Rain Gardens Level 1 Design - Pervious	Acre-Treated	$19,000	350	$6,650,000
Rain Gardens Level 1 Design – Impervious	Acre-Treated	$94,000	150	$14,100,000
Bioretention Facilities Level 1 Design - Pervious	Acre-Treated	$19,000	140	$2,660,000
Bioretention Facilities Level 1 Design - Impervious	Acre-Treated	$94,000	60	$5,640,000
Vegetated Buffers	Feet	$1	20,000	$20,000
Total				**$35,850,000**

5.5.6 Technical Assistance

It will require $60,000 to support the salary, benefits, travel, training, and incidentals for one technical FTE. A total of 3 FTEs per year (one for each SWCD) is estimated to be needed for Stages I and II resulting in a total technical assistance need of $2.4 Million.

5.6 Benefit Analysis

The primary benefit of implementation is cleaner waters in Virginia. Specifically, *E. coli* contamination in Chickahominy River will be reduced to meet water quality standards. **Table 5.14** indicates the cost efficiencies of the various practices being proposed in this IP. This table shows the BMP in the analysis, and the amount of money spent to reduce one billion coliform forming unit (cfu). The Targeting Section 6.3 shows how these values can be used to target the BMPs in order of their efficiency of removing bacteria per their cost of installation.

It is hard to gage the impact that reducing *E. coli* contamination will have on public health, as most cases of waterborne infection are not reported or are falsely attributed to other sources. However, because of the reductions required, the incidence of infection from *E. coli* sources through contact with surface waters should be reduced considerably. Reductions in bacteria and other pathogens through the implementation of the BMPs in this plan will ensure that recreation within the Chickahominy River can continue safely. Also many of the BMPs recommended in

this plan will help reduce erosion or filter sediments and nutrients from runoff water, which will help meet load reductions needed in local sediment TMDLs and the Chesapeake Bay TMDL.

Pet Waste Pick-up program, Horse Waste Storage/Composting/Education, retention ponds on pasture, and improved pasture management are among the best measure that provide the highest bacteria reduction for the money spent in the Chickahominy River watershed. On the other hand, the cost for the return on fencing out horses is quite high. This could be due to the fact that while only a small fraction of horses were assumed to have access to streams, half the fencing in the watershed was assumed to go towards horse fencing.

Table 5.14 Cost efficiencies of control measures in dollars spent per one billion cfu removed.

BMPs	Dollar per 1 Billion cfu Reduced ($ / Billion cfu)
Agricultural:	
Livestock Exclusion with Riparian Buffer (LE-1T)	274
Stream Protection (WP-2T)	146
Cattle Fencing on Intermittent Stream	274
Non-cost-share Horse Fencing	94,054
Improved Pasture Management (NRCS 528)	1
Conservation Tillage – Cropland (SL-15A)	5
Riparian Buffers – Cropland	13
Retention Ponds - Pasture	1
Retention Ponds - Cropland	128
Waste Storage/Composting/Education – Horse	1
Residential:	
Septic System Repair (RB-3)	16
Septic System Installation/Replacement (RB-4)	37
Alternative Waste Treatment System Installation (RB-5)	92
Sewer Connection	148
Retention Ponds	7
Rain Gardens Level 1 Design – Impervious	818
Rain Gardens Level 1 Design – Pervious	165
Bioretention Facilities Level 1 Design – Impervious	636
Rain Gardens Level 1 Design – Pervious	129
Pet Waste Pick-up / Composting Program	0.3
Pet Waste Composters	0.3
Vegetated Buffer – Developed land	25

An important objective of the implementation plan is to foster continued economic vitality and strength. This objective is based on the recognition that healthy waters improve economic opportunities for Virginians and a healthy economic base provides the resources and funding necessary to pursue restoration and enhancement activities. The agricultural and residential practices recommended in this document will provide economic benefits to the community, as well as the expected environmental benefits. Specifically, alternative (clean) water sources, exclusion of cattle from streams, improved pasture management, and private sewage system maintenance will each provide economic benefits to land owners. Additionally, money spent by landowners and state agencies in the process of implementing this plan will stimulate the local economy.

5.6.1 Agricultural BMPs

A clean water source has been shown to improve weight gain and milk production in cattle. Fresh clean water is the primary nutrient for livestock with healthy cattle consuming, on a daily basis, close to 10% of their body weight during winter and 15% of their body weight in summer. Beef producers in several Virginia counties have reported weight gains in cattle after providing alternative water sources. Studies also show increased milk and butterfat production from dairy cattle ingesting water from a clean source (Zeckoski et al, 2007). Many livestock illnesses can be spread through contaminated water supplies. For instance, coccidia can be delivered through feed, water and haircoat contamination with manure (VCE, 2000). In addition, horses drinking from marshy areas or areas where wildlife or cattle carrying Leptospirosis have access tend to have an increased incidence of moonblindness associated with Leptospirosis infections (VCE, 1998b). A clean water source can prevent illnesses that reduce production and incur the added expense of avoidable veterinary bills.

In addition to reducing the likelihood of animals contracting waterborne illnesses by providing a clean water supply, streamside fencing excludes livestock from wet, swampy environments as are often found next to streams where cattle have regular access. Keeping cattle in clean, dry areas has been shown to reduce the occurrence of mastitis and foot rot. The VCE (1998a) reports that mastitis costs producers $100 per cow in reduced quantity and quality of milk produced. On a larger scale, mastitis costs the U.S. dairy industry about $1.7 billion to 2 billion annually or 11% of total U.S. milk production. While the spread of mastitis through a dairy herd can be

reduced through proper sanitation of milking equipment, mastitis-causing bacteria can be harbored and spread in the environment where cattle have access to wet and dirty areas. Installation of streamside fencing and well managed loafing areas will reduce the amount of time that cattle have access to these areas.

Taking the opportunity to install an improved pasture management system in conjunction with installing clean water supplies will also provide economic benefits for the producer. Improved pasture management can allow a producer to feed less hay in winter months, increase stocking rates by 30 to 40 % and, consequently, improve the profitability of the operation. With feed costs typically responsible for 70 to 80 % of the cost of growing or maintaining an animal, and pastures providing feed at a cost of 0.01 to 0.02 cents/lb of total digestible nutrients (TDN) compared to 0.04 to 0.06 cents/lb TDN for hay, increasing the amount of time that cattle are fed on pasture is clearly a financial benefit to producers (VCE, 1996). Standing forage utilized directly by the grazing animal is always less costly and of higher quality than the same forage harvested with equipment and fed to the animal. In addition to reducing costs to producers, intensive pasture management can boost profits by allowing higher stocking rates and increasing the amount of gain per acre. Another benefit is that cattle are closely confined allowing for quicker examination and handling. In general, many of the agricultural BMPs recommended in this document will provide both environmental benefits and economic benefits to the farmer.

5.6.2 Residential BMPs

The residential programs will play an important role in improving water quality, since human waste can carry with it human viruses in addition to the bacterial and protozoan pathogens that all fecal matter can potentially carry. In terms of economic benefits to homeowners, an improved understanding of on-site sewage treatment systems, including knowledge of what steps can be taken to keep them functioning properly and the need for regular maintenance, will give homeowners the tools needed for extending the life of their systems and reducing the overall cost of ownership. The average septic system will last 20 to 30 years if properly maintained. Proper maintenance includes: knowing the location of the system components and protecting them (*e.g.*, not driving or parking on top of them), not planting trees where roots could damage the system, keeping hazardous chemicals out of the system, and pumping out the septic tank every 3 to 5 years. The cost of proper maintenance, as outlined here, is relatively inexpensive ($450) in

comparison to repairing or replacing an entire system ($8000). Additionally, the repair/replacement and pump-out programs will benefit owners of private sewage (*e.g.,* septic) systems, particularly low-income homeowners, by sharing the cost of required maintenance.

In addition to the benefits to individual landowners, the economy of the local community will be stimulated through expenditures made during implementation, and the infusion of dollars from funding sources outside the impaired areas. Building contractors and material suppliers who deal with septic system pump-outs, private sewage system repair and installation, fencing, and other BMP components can expect to see an increase in business during implementation. Additionally, income from maintenance of these systems should continue long after implementation is complete. As will be discussed in greater detail in Chapter 8, a portion of the funding for implementation can be expected to come from state and federal sources. This portion of funding represents money that is new to the area and will stimulate the local economy. In general, implementation will provide not only environmental benefits to the community, but economic benefits as well, which, in turn, will allow for individual landowners to participate in implementation.

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6. MEASURABLE GOALS AND MILESTONES FOR ATTAINING WATER QUALITY STANDARDS

Given the scope of work involved with implementing these BMPs, full implementation and de-listing from the Virginia Section 305(b)/303(d) list is expected within 15 years. Described in this section are identification of milestones, a timeline for implementation, and targeting of control measures. The overall goal of the TMDL/IP program is that the impaired streams within this project meet the water quality standards.

6.1 Milestones Identification

The end goal of implementation is restored water quality of the impaired waters and subsequent de-listing of the waters from the Commonwealth of Virginia's Section 305(b)/303(d) list within 15 years. Progress toward this goal will be assessed during implementation through tracking of control measure installations and continued water quality monitoring. Agricultural control measures will be tracked through the Virginia Agricultural Cost-Share Program by DCR and the Soil and Water Conservation Districts (SWCDs). Residential waste treatment BMPs will be tracked by the local VDH.

Following the idea of a staged implementation approach, resources and finances should be concentrated on the most cost-efficient and easy to implement control measures first. Concentrating on implementing livestock exclusion fencing, improving pasture management, residential waste treatment BMPs, horse waste storage/composting/education program, and a community pet waste pick-up program within the five years (Stage I) may provide the highest return on water quality improvement with the least cost to landowners. Stage II focuses on ponds. Some measures such as vegetated buffers and horse fencing are split between both stages.

Implementation is anticipated to begin in 2013, after which three milestones will be sought over the next 15 years (**Table 6.1**). Measures that were implemented during 2012 should also be counted towards the completion of implementation since such measures took place after existing conditions were modeled within the watershed. The first milestone will be 5 years after implementation begins, whereby the most cost-efficient and easy to implement control measures will be installed, with significant reductions in bacteria anticipated. During and after Stage I

implementation, the Steering Committee should evaluate water quality improvements and determine how to proceed to complete implementation. Stage II shows what is recommended for complete implementation. Based on completing Stage I and II, the final Stage III would be achieving the bacteria reductions required by the TMDL and this is anticipated by 2027.

Depending on the spatial focus on implementing the measures within the watershed, and acknowledging that the rate of implementing measures may vary from one area or subwatershed to another, some areas may meet the water quality standards earlier than other areas. This is why it is advised that monitoring continues on all impairments and not only the watershed outlet to assess progress where ever is necessary.

An IP describes a scenario of BMPs which are aimed at achieving the pollutant reductions outlined in a TMDL study. The BMPs chosen in this IP are not the only types which stakeholders can choose to implement, rather they are merely options among many. DEQ does not intend for the IP to be a prescriptive document, rather, it is a tool that watershed stakeholders may use to reach watershed bacteria reduction goals. While the development of an IP is required by Virginia state law, many of the BMPs outlined in this IP document are voluntary practices (some are mandatory such as correcting straight pipes or failing septic systems). The implementation of BMPs will not be done by any one locality, city, non-profit organization, or government agency. Rather, all stakeholders including citizens, will be responsible for implementing BMPs in the watershed in order to reach the bacteria reduction goals outlined in the TMDL.

Table 6.1 All Stage I and Stage II implementation goals for the study area.

BMPs	Unit	Stage I Units	Stage II Units	Cost per Unit	Stage I Cost ($)	Stage II Cost ($)	Total Cost
Agricultural BMPs							
Livestock Exclusion with Riparian Buffer (LE-1T)	System	13	0	$15,000	$195,000	$0	$195,000
Stream Protection (WP-2T)	System	2	0	$8,000	$16,000	$0	$16,000
Cattle Fencing on Intermittent Stream	System	41	0	$15,000	$615,000	$0	$615,000
Non-cost-share Horse Fencing	System	29	29	$30,000	$870,000	$870,000	$1,740,000
Improved Pasture Management (NRCS 528)	Acre	11,623	11,622	$150	$1,743,450	$1,743,300	$3,486,750
Conservation Tillage – Cropland (SL-15A)	Acre	419	0	$100	$41,900	$0	$41,900
Riparian Buffers – Cropland	Feet	10,000	10,000	$1	$10,000	$10,000	$20,000
Retention Ponds - Cropland	Acre-Treated	0	3,000	$200	$0	$600,000	$600,000
Retention Ponds - Pasture	Acre-Treated	0	13,850	$200	$0	$2,770,000	$2,770,000
Streamside Fence Maintenance	Feet	0	8,939	$3.50	$0	$31,287	$31,287
Waste Storage/Composting/Education – Horse	System	143	47	$3,000 per system + $21,500	$450,500	$141,000	$591,500
Technical Assistance	FTE	7.5	7.5	$60,000	$450,000	$450,000	$900,000
Subtotal					**4,391,850**	**6,615,587**	**11,007,437**
Residential BMPs							
Septic Systems Pump-outs (RB-1)	System	5,234	5,234	$450	$2,355,300	$2,355,300	$4,710,600
Septic System Repair (RB-3)	System	100	0	$3,500	$350,000	$0	$350,000
Septic System Installation/Replacement (RB-4)	System	75	0	$8,000	$600,000	$0	$600,000
Alternative Waste Treatment System Installation (RB-5)	System	2	0	$20,000	$40,000	$0	$40,000
Sewer Connection	System	245	0	$32,000	$7,840,000	$0	$7,840,000
Pet Waste Pick-up/Composters Program	Program	75%	25%	$370,976	$278,232	$92,744	$370,976
Retention Ponds – Mixed (pervious and impervious)	Acre-Treated	0	5,000	$1,356	$0	$6,780,000	$6,780,000
Rain Gardens Level 1 Design - Pervious	Acre-Treated	175	175	$19,000	$3,325,000	$3,325,000	$6,650,000
Rain Gardens Level 1 Design – Impervious	Acre-Treated	75	75	$94,000	$7,050,000	$7,050,000	$14,100,000
Bioretention Facilities Level 1 Design - Pervious	Acre-Treated	35	105	$19,000	$665,000	$1,995,000	$2,660,000
Bioretention Facilities Level 1 Design - Impervious	Acre-Treated	15	45	$94,000	$1,410,000	$4,230,000	$5,640,000
Vegetated Buffers	Feet	10,000	10,000	$1	$10,000	$10,000	$20,000
Residential Education Program	Program	100%	0%	$11,500	$11,500	$0	$11,500
Technical Assistance	FTE*	7.5	7.5	$60,000	$450,000	$450,000	$900,000
Subtotal					**$24,385,032**	**$26,288,044**	**$50,673,076**
IP Total					**Stage I $28,776,882**	**Stage II $32,903,631**	**$61,680,513**

*FTE is annual Full Time Equivalent

6.2 Timeline

Table 6.2 below shows the approximate breakdown of BMP installation during Stages, the estimated percent violations of the geometric mean standard, and the percent of the total cost. It is anticipated that the Steering Committee will reconvene after each 5 years to evaluate BMP installation progress and water quality monitoring results.

The TMDL model (HSPF) was used to estimate the water quality (geometric mean) of the impaired streams at each outlet (mouth) in order to show the Steering Committee estimated water quality results near the listing DEQ monitoring stations.

The progress toward meeting the WQS differs for each impairment, as is expected from the modeling results and in reality. This depends on the severity of the impairment at existing conditions (how badly impaired it is at the start of implementation), the types of BMPs needed, the placement of BMPs into the stages, and so on.

Table 6.2 Timeline for implementation in the watershed.

Implementation Milestones	Stage I, Year 5	Stage II, Year 10
Agricultural BMPs	**Cumulative Progress Toward BMP Installation**	
Livestock Exclusion with Riparian Buffer (LE-1T)	100%	100%
Stream Protection (WP-2T)	100%	100%
Cattle Fencing on Intermittent Stream	100%	100%
Non-cost-share Horse Fencing	50%	100%
Improved Pasture Management (NRCS 528)	50%	100%
Conservation Tillage – Cropland (SL-15A)	100%	100%
Riparian Buffers – Cropland	50%	100%
Retention Ponds - Cropland	0%	100%
Retention Ponds - Pasture	0%	100%
Streamside Fence Maintenance	0%	100%
Waste Storage/Composting/Education – Horse	75%	100%
Technical Assistance	50%	100%
Residential BMPs		
Septic Systems Pump-outs (RB-1)	50%	100%
Septic System Repair (RB-3)	100%	100%
Septic System Installation/Replacement (RB-4)	100%	100%
Alternative Waste Treatment System Installation (RB-5)	100%	100%
Sewer Connection	100%	100%
Retention Ponds – Mixed (pervious and impervious)	0%	100%
Rain Gardens Level 1 Design - Pervious	50%	100%
Rain Gardens Level 1 Design – Impervious	50%	100%
Bioretention Facilities Level 1 Design - Pervious	25%	100%
Bioretention Facilities Level 1 Design - Impervious	25%	100%
Vegetated Buffers	50%	100%
Residential Education Program	100%	100%
Technical Assistance	50%	100%
Estimated % Cost of Total Implementation Cost	47%	100%
Estimated % Bacteria Reduction of Total Reduction Goal	52%	100%
Estimated % Violation of Geometric Mean Standard (126 cfu/100mL)		
Collins Run (VAP-G07_CNR01A00)	2%	0%
Beaverdam Creek (VAP-G06R_BEV01A00)	1%	0%
Boatswain Creek (VAP-G06R_BTS01A02)	4%	0%
Chickahominy River (VAP-G06R_CHK01A98), Outlet of NTU 103	0%	0%
Stony Run (VAP-G05R_SNF01A02)	5%	0%
Upham Brook TMDL	1%	0%
White Oak Swamp TMDL	7%	0%
Main outlet of entire study area, Outlet of NTU 90.1	0%	0%

6.3 Targeting

Implicit in the process of a staged implementation is targeting of BMPs. Targeting ensures optimum utilization of resources. The study area was divided into 27 subwatersheds (Figure 3.1). These subwatersheds were ranked based on different criteria for stakeholders to use as a guide on where to start implementation or education first.

One method of targeting involves considering the cost-efficiency of specific practices. Table 5.14 indicates the cost-efficiencies of the practices proposed in this IP. Practices with high cost-efficiencies, relative to other practices, will provide the greatest benefit per dollar invested. Using this table as a guide, as well as knowledge regarding the source of bacteria removed, the Agricultural BMPs should be promoted with this list of prioritization in mind: Improved Pasture Management (NRCS 528), Horse Waste Storage/Composting/Education, Conservation Tillage – Cropland (SL-15A), Riparian Buffers – Cropland, Livestock Exclusion Systems, and Conservation Tillage (SL-15A). From a strictly financial point of view, horse fencing should be given the least priority.

Using Table 5.14 as a guide, as well as knowledge regarding the source of bacteria removed, Residential BMPs should be promoted with this list of prioritization in mind: Pet Waste Pick-up / Composting Program shows the best return for the money. While the pet composters are very helpful in theory, working group members were not very enthusiastic about the measure due to concerns with lack of proper use of the composted. Retention ponds also have a high return for the amount of money spent but were placed in Stage II due to complexity of implementation. In dealing with human waste sources, repairing failing septic systems should be given the most priority followed by Septic System Installation/Replacement (RB-4), Alternative Waste Treatment System Installation (RB-5), and connecting to the sewer network.

The spatial targeting of residential waste treatment BMP needs was derived from ranking the number of failing septic systems and number of straight pipes in each subwatershed, while taking into account if an impaired stream segment was present in the subwatershed. County personnel could initiate contact with residents regarding residential waste treatment needs by area in the order of priority in **Table 6.3**. Not all subwatersheds contained a failing septic system or straight

pipe based on the TMDL estimates. Targeting may increase the effectiveness of BMPs by reducing more bacteria per dollar invested.

Table 6.3 Spatial targeting results for Residential Waste Treatment System Needs.

Sub	Stream	Res. Waste Treatment Targeting Ranking
26	Upham Brook	1st
25	Beaverdam Creek	2nd
27	Stony Run	3rd
10	Chickahominy River	4th
22	White Oak Swamp	5th
24	Boatswain Creek	6th
19	Collins Run	7th
9	Chickahominy River	8th
11	Chickahominy River	9th
6	Chickahominy River	10th
16	Chickahominy River	11th
7	Chickahominy River	12th
5	Chickahominy River	13th
15	Chickahominy River	14th
8	Chickahominy River	15th
1	Chickahominy River	16th
14	Chickahominy River	17th
21	Jones Run	18th
13	Chickahominy River	19th
4	Chickahominy River	20th
12	Chickahominy River	21st
2	Chickahominy River	22nd
23	Boar Swamp	23rd
3	Chickahominy River	24th
20	Dockman Swamp	25th
17	Collins Run	26th
18	Collins Run	27th

Another targeting analysis was done using the number of dogs per acre, while taking into account if an impaired stream segment was present in the subwatershed. Parks, open spaces, subdivisions, and common areas could be canvassed for dog waste station needs by the subwatershed priority order in **Table 6.4**. Mailings to homeowners, flyer/brochure distribution,

and education to businesses could also follow this priority order. Targeting may increase the effectiveness of BMPs by reducing more bacteria per dollar invested.

Table 6.4 Spatial targeting results for Dog Waste Pick-up/Composters BMPs.

Sub	Stream	Dog Waste Pick-Up Program Targeting Ranking
26	Upham Brook	1st
11	Chickahominy River	2nd
25	Beaverdam Creek	3rd
9	Chickahominy River	4th
10	Chickahominy River	5th
27	Stony Run	6th
22	White Oak Swamp	7th
24	Boatswain Creek	8th
19	Collins Run	9th
18	Collins Run	10th
12	Chickahominy River	11th
14	Chickahominy River	12th
16	Chickahominy River	13th
13	Chickahominy River	14th
15	Chickahominy River	15th
7	Chickahominy River	16th
23	Boar Swamp	17th
6	Chickahominy River	18th
8	Chickahominy River	19th
3	Chickahominy River	20th
4	Chickahominy River	21st
5	Chickahominy River	22nd
2	Chickahominy River	23rd
1	Chickahominy River	24th
20	Dockman Swamp	25th
21	Jones Run	26th
17	Collins Run	27th

7. STAKEHOLDERS AND THEIR ROLE IN IMPLEMENTATION

Achieving the goals of this effort (*i.e.,* improving water quality and removing these waters from the impaired waters list) is dependent upon stakeholder participation. Both the local stakeholders charged with implementation of control measures and the stakeholders charged with overseeing our nation's human health are key elements of a successful IP. The first step is to acknowledge that a water quality problem exists and realize that changes must be made in operations, programs, and legislation to address this problem. The following sections in this chapter describe the responsibilities and expectations for the various components of implementation.

7.1 Integration with Other Watershed Plans

Each watershed in the state is under the jurisdiction of a multitude of individual, yet related, water quality programs and activities, many of which have specific geographic boundaries and goals. These include but are not limited to TMDLs, Roundtables, Water Quality Management Plans, erosion and sediment control regulations, stormwater management, Source Water Protection Program, and local comprehensive plans. Coordination of the implementation project with these existing programs could result in additional resources and increased participation. Also there are many volunteer organizations within the study area that are currently promoting many BMPs that will benefit water quality. A few are mentioned here.

Chesapeake Bay TMDL

This project watershed is within the Chesapeake Bay Watershed Implementation Plan drainage area. Many BMPs that address bacteria reduction will also help reduce nutrients and sediment from entering the waterways (http://www.deq.virginia.gov/Programs/Water/ChesapeakeBay/ChesapeakeBayWatershedImplementationPlan.aspx). With overlapping BMP implementation goals, coordination between lead agencies and the documentation of work completed is important.

Chickahominy River Benthic TMDL

A Benthic TMDL is currently being developed for the upper portion of the Chickahominy River watershed. The most probable stressor was identified as sediment and therefore, measures will

be taken to reduce sediment transport to the Chickahominy River. Most sediment reducing measures also have a similar effect in reducing bacteria load to water bodies.

Alliance for the Chesapeake Bay (ACB)

The Alliance is unique in its focus on collaboration to address issues that affect the Bay and its streams and rivers. They engage, educate, partner and inspire through work with other organizations, communities, businesses and individuals. Their strength is in developing innovative solutions that can be implemented to protect the Bay. They believe long-term strategies and actions to protect and enhance the Bay can be achieved through collaboration and common goals (https://allianceforthebay.org/). They have partnered with the Chesapeake Bay Foundation (CBF) on the Upham Brook Restoration Project (https://allianceforthebay.org/2012/04/upham-brook-watershed-restoration) and are training volunteers to conduct homeowner stormwater runoff audits through their Chesapeake RiverWise Communities program. They are also training volunteers to be water quality monitors through the RiverTrends program.

James River Association

Chickahominy River is a tributary to the James River. The James Riverkeeper Program was launched in 2001 when JRA joined the Waterkeeper Alliance. The Waterkeeper Alliance is a growing international organization with over 153 local "Riverkeeper", "Baykeeper", and "Coastkeeper" programs, all dedicated to protecting local waters from pollution. The idea for this program stemmed from a concept dating back to old England, and was started in America in 1983 with the Hudson Riverkeeper. JRA's Riverkeeper monitors the length of the James River and its more than 15,000 miles of tributaries. They are on the water in a jon boat, kayak, canoe or doing river reconnaissance on foot and by vehicle 2 to 3 days each week (http://www.jamesriverassociation.org/what-we-do/river-keepers).

A program named River Hero Home was launched in 2012. The River Hero Homes is a way to recognize homeowners who are successfully taking steps to improve water quality by reducing the amount of stormwater and pollution leaving their property to help protect the James River. To become a River Hero Home, three simple steps must be completed. These steps, which

include installing a river friendly practice such as rain barrels and everyday actions such as picking up after your pet and reducing fertilizer use, may seem trivial, but they can all have significant impacts on water quality. To participate, a homeowner must fill out the on-line application and send a picture of their river friendly practice. Once the application is received, the homeowner is contacted and certification materials are sent. Every certified home receives an attractive garden flag and window cling with the River Hero Home logo, access to a dedicated Google group and newsletter, and an invitation to the annual River Hero Homes Lawn Party. Members also receive exclusive discounts at participating local garden shops and nurseries. Finally, depending on the address of the participant, becoming a certified River Hero Home may also help participants qualify for stormwater rebates or credits offered by your locality.

The Middle James Roundtable

The Middle James Roundtable is a collaborative effort among various stakeholders in the Middle James watershed to improve water quality and the overall health of our communities. Roundtable stakeholders include elected officials, local government staff, the agricultural community, planning district commissions, business and industry, water and sewer utilities, commercial fishermen, soil and water conservation districts, developers, interested citizens, environmental groups, tourism and recreational groups, state and federal agency staff and public service authorities. Roundtable activities are dictated by the participants and can involve activities such as hosting forums to discuss local watershed issues and land use, educating citizens about water quality, grant writing, coordinating workshops, social marketing campaigns, collecting and analyzing water quality data and planning and implementation of watershed goals. The Middle James Roundtable consists of a steering committee, which meets quarterly. An executive committee, elected from current steering committee members by steering committee members meets monthly. The Roundtable also holds a yearly meeting that focuses on local water quality issues (http://mjrt.org/).

Operating under the joint partnership of the Middle James Roundtable and the James River Advisory Council is the Richmond Regional Pet Waste Committee. Their stakeholders created the "Stop the Drop" public education campaign and the "P.U.P. Club" on Facebook (www.facebook.com/RichmondPUPclub) as a way to educate citizens on the impacts of pet

waste on water quality. The committee consists of representatives from state and local governments, non-profits and other constituent groups. Through the campaign, the committee aims to create uniformity in the information that is being presented about pet waste throughout the region. For more information, the committee coordinator may be contacted by email at info@mjrt.org.

Stormwater Management Programs

Multiple jurisdictions exist within the Chickahominy River watershed with varying stormwater management programs. This includes the City of Richmond Department of Public Utilities, Hanover County Department of Public Works, and Henrico County Department of Public Works. The Richmond programs encourage private homeowners, businesses, industry and landowners within the City to design and install LID BMPs to reduce stormwater volumes and increase runoff water quality from their properties. Single-family residents are encouraged to install rain gardens, on-site rainwater storage devises, vegetated filter strips, and pervious pavement. Non-residential and multi-family property owners are encouraged to install any of the following practices: grassed channels, permeable pavement, infiltration practices, bioretention practices, dry swales, wet swales, filtering practices, constructed wetlands, wet ponds, extended detention ponds, rooftop disconnection, vegetated filters, rainwater harvesting, and vegetated roofs. A reduction of up to 50% off a stormwater bill is given for practices and combinations of practices that reduce the stormwater volumes flowing from impervious areas (http://www.richmondgov.com/ PublicUtilities/StormwaterCredits.aspx). Hanover Department of Public Works handles storm drainage and ensures compliance with Chesapeake Bay Protection and other environmental regulations.

Sanitary Sewer Overflow (SSO) Programs

Sanitary sewers are systems which collect wastewater from homes and businesses and transfer it through pipes and a series of pump stations to a treatment plant. Sewer systems are designed to accommodate a specific volume of wastewater. At the design volume, sanitary collection systems are not expected to overflow or release sewage before it is successfully delivered to the treatment plant. When wastewater exceeds design volume or if the capacity is reduced by a blockage in the piping system, wastewater will "back up" and sewage discharges may occur from

the nearest escape location (i.e. manholes, pumping stations). These are illicit discharges to the environment and are called sanitary sewer overflows (SSOs). SSOs may contain raw or untreated sewage, which contaminate streams with bacteria, viruses, nutrients and other pollutants harmful to humans and wildlife. Wastewater can also enter the environment through exfiltration via line cracks, joint gaps, or breaks in the piping system, or due to infrastructure failure. Failures are typically addressed by the sewer system owner, usually counties or municipalities, when they occur and most have long-term programs. The goal of the long-term program is to identify and repair damaged sewer lines and to address everyday maintenance issues.

The Chickahominy River and Tributaries bacteria TMDL required 100% reduction of SSOs. Like straight pipes and septic failures, SSOs are considered illicit discharges. Watershed wide, the SSOs contribute approximately 30% of the total annual bacteria load. In comparison, the watershed-wide direct human source (from failing septic and straight pipes) is estimated to contribute about 4% of the total bacteria loading. When SSOs occur, the facility is required to report the events to DEQ and are typically addressed through compliance and enforcement actions. When a facility has repeated SSOs, they may be asked to enter an agreement called a "Consent Order", which is a formal agreement between DEQ and the facility which includes a schedule of compliance for sewer system improvements.

In the Chickahominy River IP watershed, the majority of observed SSO events (~98%) occur in Henrico County, followed by Hanover County (~2%), based on reporting from localities. In comparison, the City of Richmond, Charles City and New Kent counties have fewer sewer networks within the Chickahominy River study area, which may explain the lower number of SSOs reported by these localities.

Henrico County entered into a Consent Order with DEQ beginning in 2010 with a schedule of compliance through 2018. The scheduled improvements include sewer rehabilitation and storage projects within Upham Brook, Trumpet Branch, Horse Swamp Creek, and the Chickahominy River. For the purpose of proper sewer system operation and SSO correction, Henrico County Department of Public Utilities (DPU) maintains an Inflow and Infiltration (I&I) program. Development of this program required significant engineering evaluations to complete a Wet Weather Study and a Master Facilities Plan that included implementation of a system sewer

model. Henrico County also developed a county-wide GIS system and other DPU applications for use in the collection, analysis and mapping of the data. The goal of the program is to correct I&I problems, repair damaged sewer lines, and address maintenance issues. The program is designed to reduce infiltration and inflow into the system, prevent sewage overflows, limit the number of sewer main stoppages, minimize O&M (operation and maintenance) costs, and provide safe and continuous service to sewer customers. The need for sewer rehabilitation projects are based on system-wide wet weather flow evaluations, customer complaints, evaluation by CCTV (closed-circuit television), sewer-main cleaning, and information collected during response to service calls. System improvements include cleaning and inspecting sewer pipes to identify defects; pipe line repairs; manhole inspection and repair; flow isolation and monitoring; smoke testing; dye testing; and CCTV inspection of both existing and new sewer lines. These activities and along with system information such as pipe age, pipe material, repair history, sewer backup and overflow records, and hydraulic capacity are combined and used to prioritize sewer line rehabilitation and/or replacement needs.

Related specifically to sanitary sewer overflows, Henrico County's I&I Program will incrementally improve the system response to wet weather impacts. By 2036, this program projects that a 10 year recurrence interval storm will be contained within the sanitary sewer without overflow. The Department of Public Utilities (DPU) Capital Improvement Program identifies projects based on the above stated criteria and projects the budget required to accomplish these goals. Projected budget needs specifically related to sewer rehabilitation and wet weather control requirements over the next 25 years are estimated to range from $400,000,000 to $500,000,000 (these costs do not include annual operating budget costs for ongoing maintenance programs). The availability of funding is subject to annual appropriations by the Board of Supervisors. Henrico County DPU has projected a budget of $62,000,000 for sanitary sewer rehabilitation (I&I removal) projects over the next 5 years. Funding requests are reviewed and approved by the Board of Supervisors on an annual basis. Previous years funding requests have been approved and DPU will continue to present information for funding that can be supported in annual approvals by the Board of Supervisors.

Hanover County plans to continue their current activities which it states have been successful in minimizing SSO's. The County's Department of Public Utilities has an annual operating budget

of about $17.5 million, about half of which is related to the operation and maintenance of its wastewater system. It is anticipated that these activities will increase in the future to keep up with growth and the aging of its system. The County also plans to continue investing in the infrastructure of the system which is part of their capital improvement program. At the time of IP, no large scale improvement projects were focused solely on reducing SSO's, however, the County has future projects planned to not only maintain but also to increase capacity so that SSO's will not increase due to expansion of the collection system.

Due to the magnitude of bacteria which SSOs contribute to the Chickahominy River and tributaries, sanitary sewer improvements in both Henrico and Hanover Counties should continue in the future with appropriate funding provided.

Education and outreach programs for sanitary sewer customers could help alleviate SSOs which occur as a result of pipe blockages. Often, blockages in a sanitary system will occur due to a build-up of fats, oils and grease which are dumped into residential and commercial drains. A fats, oils, and grease (FOG) audit program for restaurants and pamphlets for homeowners can educate sewer patrons on proper disposal of FOG and the impact which improper disposal can have, such as SSOs in public waterways."

Upham Brook Restoration Project

The Chesapeake Bay Foundation's (CBF's) Upham Brook Restoration Project takes a holistic approach to rehabilitating Upham Brook. CBF believes that a holistic approach to rehabilitating a watershed is an innovative concept to improving water quality. In the past, restoration efforts have often been segmented, with focus given to only one aspect of pollution, one type of restoration, or one group of constituents. CBF's Upham Brook Restoration Project has a different perspective: one where many aspects of pollution are addressed, many types of restoration projects are executed, and many members of a watershed community are engaged in rehabilitating their watershed. This project works cooperatively with several organizations with the goal of employing a broad array of activities.

The Nature Conservancy Mitigation Project

The proposed Virginia Aquatic Resources Trust Fund (VARTF) mitigation site is located on approximately 287 acres of land to be placed under easement by the Conservancy. The site is located on the Chickahominy River in Henrico and New Kent Counties, Virginia. The proposed mitigation site includes 116 acres of non-tidal forested wetlands and approximately 3,500 linear feet of streams, including frontage along both banks of the Chickahominy River and several unnamed tributaries. The proposed amendment to the mitigation site is to conduct restoration on approximately 311 lf of an unnamed tributary to the Chickahominy River and 0.5 acre of riparian buffer.

7.2 Monitoring

Improvements in water quality will be determined in the study area through monitoring conducted by the VADEQ's ambient monitoring program. The monitoring data include bacteria, physical parameters (dissolved oxygen, temperature, pH, and conductivity), nutrients and suspended and dissolved solids. The VADEQ uses the data to determine overall water quality status. The water quality status will help gauge the success of implementation aimed at reducing the amount of bacteria in the streams. In order to maximize the benefit of post-IP monitoring, VADEQ is considering to associate monitoring with extent of BMP implementation to insure that sufficient amount of BMPs has been installed with an expected improvement in water quality conditions. Therefore, the exact dates and locations of monitoring may vary by impairment.

The VADEQ monitoring stations in the study area are described in **Table 7.1** and shown in **Figure 7.1**. When post-IP monitoring is initiated, stations are monitored every other month within the monitoring period listed in Table 7.1.

Up-to-date monitoring results are available on the EPA website or by contacting local DEQ regional offices. Volunteer monitoring may be on-going in some parts of the study area. For example, citizen volunteers working in partnership with the Henricopolis SWCD will be monitoring 10 stations in 2013. In addition, Randolph Macon College will monitor along several

stations in the Lickinghole and Stony Run portions in the fall. It is also envisioned that the Henriopolis volunteers (aka the Chickahominy Swamp Rats) will monitor streams within the watershed during implementation.

Randolph-Macon College's Environmental Studies Program (R-MC) initiated a sampling study to identify sources of fecal coliform bacteria in the Stony Run watershed in Fall 2012. The study objective was to develop a sampling plan which would more narrowly-define the contributors of *E. coli* within the watershed. The group evaluated VADEQ data in conjunction with landuse trends in an attempt to locate expected areas of high *E. coli*. The evaluation was used in the selection of potential sample sites which were later revised based on field observations and bacteria analysis of water samples collected. The group collected water samples from sites in Stony Run and Lickinghole Creek on November 20 and November 27, 2012. Several samples exceeded the recreational standard for E.*coli*, with the majority of violations occurring at sites within the Town of Ashland. One site at the intersection of Stony Run and Center Street exceeded standards in both VADEQ and R-MC samples. This particular site is downstream of a pond that is accessible by cattle, however, the group also identified an additional eutrophic pond in the subwatershed. The group suggests future monitoring efforts should center on identifying unknown sources of *E. coli* bacteria within the watershed based on observed high bacteria concentrations and percent of samples exceeding the Instantaneous Maximum Standard. Only one water sample from Lickinghole Creek, taken at the intersection of Lickinghole Creek and Lewistown Road, exceeded the recreational standard, whereas a sample taken approximately 10m upstream met the standard. These findings suggest local sources of *E. coli* are prevalent in the watershed (Fenster and White 2012).

The group concluded that bacteria violations in VADEQ stations were not correlated to the length of sewer line, amount of development, or amount of agriculture in the subwatersheds upstream from each sample location. The group also determined that bacteria violations in VADEQ sample points generally decreased downstream and bacteria concentrations at individual sites fluctuated irrespective to sample date and weather condition. The group could find no spatial or temporal persistence of bacteria in the Stony Run watershed and bacteria violations appeared to be a product of local conditions rather than regional trends. Finally, the group proposed that a long term monitoring program at 22 sites in the Stony Run watershed,

based on their site selection, would increase the ability of identifying point and non-point source contributors of *E. coli*. A link to the groups' complete report is available at http://www.rmc.edu/Academics/environmental-studies/Projects.aspx, under the " Development of a Water Quality Sampling Plan for the Stony Run Watershed, a Tributary to the Chickahominy River" link (Fenster and White 2012).

The Chickahominy Swamp Rats received a citizen monitoring grant from DEQ in 2013. The group held a workshop to advertise the monitoring efforts, educate local citizens about water quality issues, to highlight the partnerships formed with the James River Association and the National Park Service, to provide a citizen monitoring training, and to ask locals to participate in the monitoring efforts. Information and details may be obtained by contacting personnel at chickahominyswamprats@gmail.com.

Table 7.1 Monitoring station IDs, station locations, and monitoring schedules for the VADEQ stations within the study area.

Station ID	Stream Name and Location	Tentative Monitoring Period*	Frequency
2-WOS002.69	White Oak Swamp, RT. 156 BRIDGE	1/2016-12/2017, 1/2021-12/2023	Bi-monthly
2-UPM003.53	Upham Brook, RT. 1 BRIDGE (BROOK ROAD)	1/2016-12/2017, 1/2021-12/2023	Bi-monthly
2-CNR001.58	Collins Run just above Dockman Swamp	1/2016-12/2017, 1/2021-12/2023	Bi-monthly
2-BTS002.62	Boatswain Creek at Watt House driveway	1/2016-12/2017, 1/2021-12/2023	Bi-monthly
2-BEV002.00	Beaverdam Creek, RT 156 BRIDGE	1/2016-12/2017, 1/2021-12/2023	Bi-monthly
2-SNF000.23	Stony Run, I-95 NB exit ramp from Rt656	1/2016-12/2017, 1/2021-12/2023	Bi-monthly
2-LKH000.04	Lickinghole Cr., I-95 NB ramp from Rt 656	1/2016-12/2017, 1/2021-12/2023	Bi-monthly
2-CHK062.57	Chickahominy River, RT. 360 BRIDGE	1/2016-12/2017, 1/2021-12/2023	Bi-monthly
2-CHK055.04	Chickahominy River, RT. 156 BRIDGE	1/2016-12/2017, 1/2021-12/2023	Bi-monthly
2-CHK032.77	Chickahominy River, RT. 155 BRIDGE	1/2016-12/2017, 1/2021-12/2023	Bi-monthly

,"*Schedule dependent on implementation efforts completed within subwatersheds, availability of funding and staff, and agency discretion.

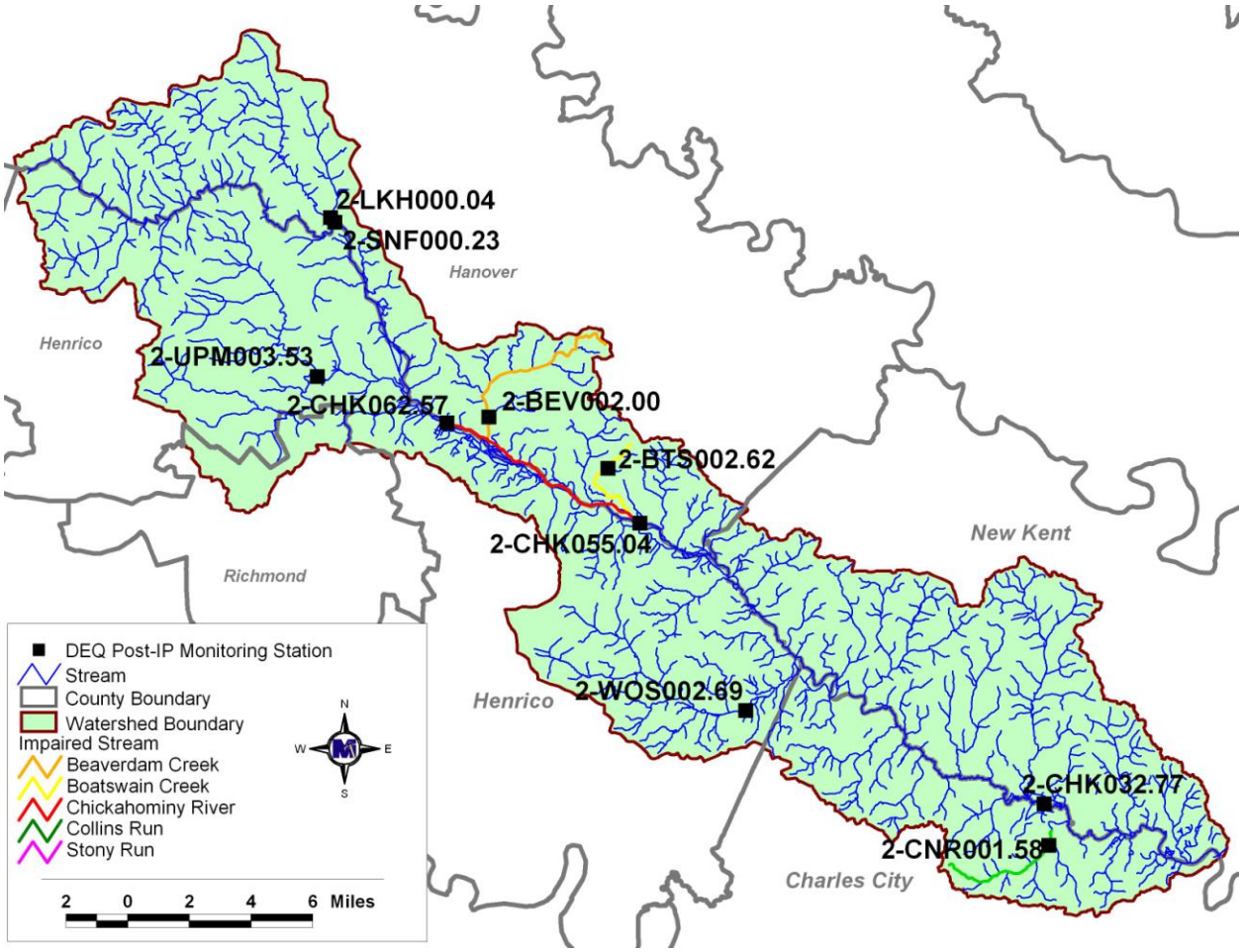

Figure 7.1 Location of monitoring stations in the study area.

7.3 Agricultural and Residential Education Programs

Education and outreach is a significant component of any TMDL implementation project. The SWCDs will be in charge of initiating contact with residents and farmers to encourage the installation of BMPs. This one-on-one contact will facilitate communication of the water quality problems and the corrective actions needed. The district staff can conduct a number of outreach activities in the watershed to promote participation and community support to attain the IP milestones and to make the community aware of the TMDL requirements. Such activities could include information exchange through newsletters, mailings, field days, demonstrations, organizational meetings, etc. The staff will work with appropriate organizations to educate the public. Grazing land/ forage workshops, possibly with the Virginia Forage and Grassland Council, are venues to distribute agricultural education materials. Specific agricultural and

residential outreach ideas are outlined in section 5.4. A residential education program consisting of educational materials about pet waste and a pet waste composter program will be cost-effective options.

7.3.1 Soil & Water Conservation Districts (SWCD)

The SWCD is a local government entity providing soil and water conservation assistance to farmers and residents. During the implementation project, the SWCDs will provide outreach, technical and financial assistance to farmers and homeowners in the study area through the Virginia Agricultural BMP Cost-Share and Tax Credit programs. Their responsibilities will include promoting implementation goals, available funding and the benefits of BMPs and providing assistance in the survey, design, layout, and approval of agricultural and residential BMPs. Education and outreach activities are a significant portion of their responsibilities. The SWCDs will be eligible for technical assistance funding to support their duties.

7.4 Legal Authority

State government has the authority to establish state laws that control delivery of pollutants to local waters. Local governments, in conjunction with the state, can develop ordinances involving pollution prevention measures. In addition, citizens have the right to bring litigation against persons or groups of people shown to be causing some harm to the claimant. The judicial branch of government also plays a significant role in the regulation of activities that impact water quality through hearing the claims of citizens in civil court and the claims of government representatives in criminal court.

7.4.1 EPA

The EPA has the responsibility of overseeing the various programs necessary for the success of the CWA. However, administration and enforcement of such programs falls largely to the states. In the Commonwealth of Virginia, water quality problems are dealt with through legislation, incentive programs, education, and legal actions. Currently, there are four state agencies responsible for regulating activities that impact water quality in Virginia. These agencies are VADEQ, VADCR, VDH, and Virginia Department of Agriculture and Consumer Services (VDACS).

7.4.2 VADEQ

VADEQ has responsibility for monitoring waters to determine compliance with state standards, and for requiring permitted point dischargers to maintain loads within permit limits. It has the regulatory authority to levy fines and take legal action against those in violation of permits. Beginning in 1994, animal waste from confined animal facilities that hold in excess of 300 animal units (cattle and hogs) has been managed through a Virginia general pollution abatement permit. These operations are required to implement a number of practices to prevent surface and groundwater contamination. In response to increasing demand from the public to develop new regulations dealing with animal waste, the Virginia General Assembly passed legislation in 1999 requiring VADEQ to develop regulations for the management of poultry waste in operations having more than 200 animal units of poultry (about 20,000 chickens) (ELI, 1999). On January 1, 2008 DEQ assumed regulatory oversight of all land application of treated sewage sludge, commonly referred to as biosolids as a directed by the Virginia General Assembly in 2007. DEQ's Office of Land Application Programs within the Water Quality Division to manages the biosolids program. The biosolids program includes having and following nutrient management plans for all fields receiving biosolids, unannounced inspections of the land application sites, certification of persons land applying biosolids, and payment of a $7.50 fee per dry ton of biosolids land applied.

7.4.3 VADCR

VADCR holds the responsibility for addressing nonpoint sources (NPS) of pollution. Historically, most VADCR programs have dealt with agricultural NPS pollution through education and voluntary incentive programs. These cost-share programs were originally developed to meet the needs of voluntary partial participation and not the level of participation required by TMDLs (near 100%). To meet the needs of the TMDL program and achieve the goals set forth in the CWA, the incentive programs are continually reevaluated to account for this level of participation. Although VADCR does not have regulatory authority over the majority of NPS issues addressed here, the department does administer the MS4 stormwater permit program. Starting June 2013, the stormwater and TMDL programs at VADCR will be transferred to VADEQ.

7.4.4 ASA

Through Virginia's Agricultural Stewardship Act (ASA), the Commissioner of Agriculture has the authority to investigate claims that an agricultural producer is causing a water quality problem on a case-by-case basis (Pugh, 2001). If deemed a problem, the Commissioner can order the producer to submit an agricultural stewardship plan to the local soil and water conservation district. If a producer fails to implement the plan, corrective action can be taken which can include a civil penalty of up to $5,000 per day. The Commissioner of Agriculture can issue an emergency corrective action if runoff is likely to endanger public health, animals, fish and aquatic life, public water supply, etc. An emergency order can shut down all or part of an agricultural activity and require specific stewardship measures. VDACS has only two staff members dedicated to enforcing the Agricultural Stewardship Act, and very little funding is available to support water quality sampling. The Agricultural Stewardship Act is entirely complaint-driven.

7.4.5 VDH

The *Emergency Regulations for Alternative Onsite Sewage Systems*, adopted in April, 2010, require that all alternative onsite sewage treatment systems in Virginia be visited at least annually by a licensed operator. However, the Virginia Department of Health (VDH) does not currently have the authority, the mandate or the resources to require or conduct similar surveillance of all conventional onsite sewage treatment (septic) systems in the Commonwealth. (Note that, as resources allow, VDH may conduct or assist with such surveys that target localized areas of specific concern.)

Given the above limitations, VDH generally learns of failed septic systems directly or indirectly from the owners of those systems or through complaints from neighbors or other government agencies. Reports of straight pipes are less-frequently received from either source, since they are generally located in less-populated areas and are typically sited/intended to avoid detection.

When VDH receives a report of a non-compliant system, it performs a site inspection, if necessary, to verify the report. VDH then works with the homeowner to address the issue in an effective, timely and regulatory-compliant manner, generally through installation of a septic or alternative onsite system, repair or replacement of an existing system and/or failed components

of that system, connection to a central collection/treatment system, or other appropriate measure(s). In the case of non-cooperative homeowners, VDH initially attempts to achieve compliance through internal enforcement actions and, ultimately, through the court system.

An impasse may be reached when a homeowner is willing, but financially unable to correct the non-compliance. In such situations, VDH assists in attempting to locate funding for the needed corrections, with the knowledge that many of the existing funding sources (State Revolving Loan Fund, Water Quality Improvement Fund, etc.) have significant shortcomings with regard to the onsite wastewater treatment arena. VDH, DEQ, and DCR have discussed those shortcomings and have agreed to collaborate in an effort to identify sources of financial assistance for owners of onsite wastewater systems located in the watersheds of impaired waters.

7.4.6 Local governments

The local governments can play a very active role in in enforcing the mandatory 5 year septic tank pump-out for being in the Chesapeake Bay drainage area. Municipalities could help with education by handing out proper septic system maintenance and proper pet waste disposal literature when individuals apply for a building permit or dog license. When licenses for dog kennels are issued, the owners could be required to produce a plan for the proper disposal of waste from the facility. Future parks could be required to provide dog waste baggy stations and appropriate maintenance. Ordinances may be enacted that require picking up after pets and incentives to hooking up homes to sanitary sewer. Future subdivisions should be developed with sustainable growth practices that minimize or eliminate stormwater runoff. New development within the 100-year floodplain could be prohibited or discouraged in order for riparian areas to grow and flourish.

7.5 Legal Action

The Clean Water Act Section 303(d) calls for the identification of impaired waters. It also requires that the streams be ranked by the severity of the impairment and that a Total Maximum Daily Load be calculated for that stream that would bring it back into compliance with the set water quality standard. Currently, TMDL implementation plans are not required in the Federal Code; however, Virginia State Code does incorporate the development of implementation plans for impaired streams. EPA largely ignored the nonpoint source section of the Clean Water Act

until citizens began to realize that regulating only point sources was no longer maintaining water quality standards. Lawsuits from citizens and environmental groups citing EPA for not carrying out the statutes of the CWA began as far back as the 1970s and have continued until the present. In Virginia in 1998, the American Canoe Association and the American Littoral Society filed a complaint against EPA for failure to comply with provisions of §303d. The suit was settled by Consent Decree, which contained a TMDL development schedule through 2010. It is becoming more common for concerned citizens and environmental groups to turn to the courts for the enforcement of water quality issues.

Successful implementation depends on stakeholders taking responsibility for their role in the process. The primary role, of course, falls on the landowner. However, local, state and federal agencies also have a stake in ensuring that Virginia's waters are clean and provide a healthy environment for its citizens. An important first step in correcting the existing water quality problem is recognizing that there is a problem and that the health of citizens is at stake. Virginia's approach to correcting NPS pollution problems has been, and continues to be, encouragement of participation through education and financial incentives.

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8. POTENTIAL FUNDING SOURCES

Potential funding sources available during implementation were identified during IP development. A brief description of the programs and their requirements is provided in this chapter. Detailed descriptions can be obtained from the SWCDs, VADCR, NRCS, and VCE. It is recommended that participants discuss funding options with experienced personnel. Information on program description and requirements was provided from fact sheets prepared by Virginia State Technical Advisory Committee, VADEQ, VADCR, and Southeast Rural Community Assistance Project, Inc

Virginia Agricultural Best Management Practices Cost-Share Program

The cost-share program is funded with state and federal monies through local SWCDs. SWCDs administer the program to encourage farmers and landowners to use BMPs on their land to better control sediment, nutrient loss, and transportation of pollutants into our waters due to excessive surface flow, erosion, leaching, and inadequate animal waste management. Program participants are recruited by SWCDs based upon those factors, which have a great impact on water quality. The objective is to solve water quality problems by fixing the worst problems first. Cost-share is typically 75% of the actual cost, not to exceed the local maximum. The Virginia Water Quality Improvement Fund (WQIF) provides funding for this program, which is dependent upon a percentage of state surpluses.

Virginia Agricultural Best Management Practices Tax Credit Program

For all taxable years, any individual or corporation engaged in agricultural production for market, who has in place a soil conservation plan approved by the local SWCD, shall be allowed a credit against the tax imposed by Section 58.1-320 of an amount equaling 25% of the first $70,000 expended for agricultural best management practices by the individual. "Agricultural best management practices" are approved measures that will provide a significant improvement to water quality in the state's streams and rivers, and is consistent with other state and federal programs that address agricultural nonpoint source pollution management. Any practice approved by the local SWCD Board shall be completed within the taxable year in which the credit is claimed. The credit shall be allowed only for expenditures made by the taxpayer from funds of his/her own sources. The amount of such credit shall not exceed $17,500 or the total

amount of the tax imposed by this program (whichever is less) in the year the project was completed, as certified by the Board. If the amount of the credit exceeds the taxpayer's liability for such taxable year, the excess may be carried over for credit against income taxes in the next five taxable years until the total amount of the tax credit has been taken. This program can be used independently or in conjunction with other cost-share programs on the stakeholder's portion of BMP costs. It is also approved for use in supplementing the cost of repairs to streamside fencing.

Virginia Agricultural Best Management Practices Loan Program

Loan requests are accepted through VADEQ. The interest rate is 3% per year and the term of the loan coincides with the life span of the practice. To be eligible for the loan, the BMP must be included in a conservation plan approved by the local SWCD Board. The minimum loan amount is $5,000; there is no maximum limit. Eligible BMPs include 23 structural practices such as animal waste control facilities, loafing lot management systems, and grazing land protection systems. The loans are administered through certain participating lending institutions.

Virginia Small Business Environmental Assistance Fund Loan Program

The Fund, administered through VADEQ, is used to make loans or to guarantee loans to small businesses for the purchase and installation of environmental pollution control equipment, equipment to implement voluntary pollution prevention measures, or equipment and structures to implement agricultural BMPs. The equipment must be needed by the small business to comply with the federal Clean Air Act, or it will allow the small business to implement voluntary pollution prevention measures. The loans are available in amounts up to $50,000 and will carry an interest rate of 3%, with favorable repayment terms based on the borrower's ability to repay and the useful life of the equipment being purchased or the life of the BMP being implemented. There is a $30 non-refundable application processing fee. The Fund will not be used to make loans to small businesses for the purchase and installation of equipment needed to comply with an enforcement action. To be eligible for assistance, a business must employ 100 or fewer people and be classified as a small business under the federal Small Business Act.

Virginia Water Quality Improvement Fund

This is a permanent, non-reverting fund established by the Commonwealth of Virginia in order to assist local stakeholders in reducing point and nonpoint nutrient loads to surface waters.

Eligible recipients include local governments, SWCDs, and individuals. Grants for point sources are administered through VADEQ and grants for nonpoint sources are administered through VADCR. Most WQIF grants provide matching funds on a 50/50 cost-share basis. Successful applications are listed as draft/public-noticed agreements, and are subject to a public review period of at least 30 days. This fund was identified as a potential funding source for the urban stream buffers and pet waste composter program to be included in the implementation plan.

Virginia Environmental Endowment

"The mission of the Virginia Environmental Endowment (VEE) is to improve the quality of the environment by using its capital to encourage all sectors to work together to prevent pollution, conserve natural resources, and promote environmental literacy". Grant making priorities in the Virginia Program are focused on water quality research and monitoring of water quality conditions; land and open space conservation; Chesapeake Bay fisheries conservation, research, and education; and environmental education.

The Virginia Mini-Grant Program has enabled citizens to become actively involved in solving environmental problems in their hometowns. With grants of $5,000 or less, schools have initiated environmental science courses and outdoor classroom projects, volunteers have monitored water quality in dozens of streams and rivers, and communities have developed innovative strategies to ensure environmental quality is improved in their community. The Virginia Mini-Grant Program supports community-based efforts to strengthen environmental education and to promote stewardship. Preference is given to modest local projects. Public and private schools (K-12) and nongovernmental, nonprofit community organizations in Virginia are eligible to apply for a one-year Mini-Grant up to $5,000. Local, state, and federal government agencies and programs are not eligible. Guidelines and application form are provided on their website (http://www.vee.org/).

Community Development Block Grant Program

The Department of Housing and Urban Development sponsors this program, intended to develop viable communities by providing decent housing and a suitable living environment and by expanding economic opportunities primarily for persons of low and moderate income. Recipients may initiate activities directed toward neighborhood revitalization, economic development, and

provision of improved community facilities and services. Specific activities may include public services, acquisition of real property, relocation and demolition, rehabilitation of structures, and provision of public facilities and improvements, such as new or improved water and sewer facilities.

Conservation Reserve Program (CRP)

Offers are accepted and processed during fixed signup periods that are announced by Farm Service Agency (FSA). All eligible (cropland) offers are ranked using a national ranking process. If accepted, contracts are developed for a minimum of 10 and not more than 15 years. Payments are based on a per-acre soil rental rate. Cost-share assistance is available to establish the conservation cover of tree or herbaceous vegetation. The per-acre rental rate may not exceed the Commodity Credit Corporation's maximum payment amount, but producers may elect to receive an amount less than the maximum payment rate, which can increase the ranking score. To be eligible for consideration, the following criteria must be met: 1) cropland was planted or considered planted in an agricultural commodity for two of the five most recent crop years, and 2) cropland is classified as "highly-erodible" by NRCS. Eligible practices include planting these areas to trees and/or herbaceous vegetation. Application evaluation points can be increased if certain tree species, spacing, and seeding mixtures that maximize wildlife habitats are selected. Land must have been owned or operated by the applicant for at least 12 months prior to the close of the signup period. The payment to the participant is up to 50% of the cost for establishing ground cover. Incentive payments for wetlands hydrology restoration equal 25% of the cost of restoration.

Conservation Reserve Enhancement Program (CREP)

This program is an "enhancement" of the existing USDA CRP Continuous Sign-up. It has been "enhanced" by increasing the cost-share rates from 50% to 75% and 100%, increasing the rental rates, and offering a flat rate incentive payment to place a permanent "riparian easement" on the enrolled area. Pasture and cropland (as defined by USDA) adjacent to streams, intermittent streams, seeps, springs, ponds and sinkholes are eligible to be enrolled. Buffers consisting of native, warm-season grasses on cropland, to mixed hardwood trees on pasture, must be established in widths ranging from the minimum of 30% of the floodplain or 35 feet, whichever is greater, to a maximum average of 300 feet. Cost-sharing (75% - 100%) is available to help

pay for fencing to exclude livestock from the riparian buffer, watering facilities, hardwood tree planting, filter strip establishment, and wetland restoration. In addition, a 40% incentive payment upon completion is offered and an average rental rate of $70/acre on stream buffer area for 10-15 years. The State of Virginia will make an additional incentive payment to place a perpetual conservation easement on the enrolled area. The statewide goal is 8,000 acres.

The landowner can obtain and complete CREP application forms at the FSA center. The forms are forwarded to local NRCS and SWCD offices while FSA determines land eligibility. If the land is deemed eligible, NRCS and the local SWCD determine and design appropriate conservation practices. A conservation plan is written, and fieldwork is begun, which completes the conservation practice design phase.

FSA then measures CREP acreage, conservation practice contracts are written, and practices are installed. The landowner submits bills for cost-share reimbursement to FSA. Once the landowner completes BMP installation and the practice is approved, FSA and the SWCD make the cost-share payments. The SWCD also pays out the state's one-time, lump sum rental payment. FSA conducts random spot checks throughout the life of the contract, and the agency continues to pay annual rent throughout the contract period.

Environmental Quality Incentives Program (EQIP)

This program was established in the 1996 Farm Bill to provide a single voluntary conservation program for farmers and landowners to address significant natural resource needs and objectives. This program replaces the Agricultural Conservation Program (ACP) and the Water Quality Incentive Program (WQIP). Approximately 65% of the EQIP funding for the state of Virginia is directed toward "Priority Areas." These areas are selected from proposals submitted by a locally led conservation work group. Proposals describe serious and critical environmental needs and concerns of an area or watershed, and the corrective actions they desire to take to address these needs and concerns. The remaining 35% of the funds are directed toward statewide priority concerns of environmental needs. EQIP offers 5 to 10-year contracts to landowners and farmers to provide 75% cost-share assistance, 25% tax credit, and/or incentive payments to implement conservation practices and address the priority concerns statewide or in the priority area. Eligibility is limited to persons who are engaged in livestock or agricultural production. Eligible

land includes cropland, pasture, and other agricultural land in priority areas, or land that has an environmental need that matches one of the statewide concerns.

Wildlife Habitat Incentive Program (WHIP)

WHIP is a voluntary program for landowners and land users who want to develop or improve wildlife habitat on private agriculture-related lands. Participants work with NRCS to prepare a wildlife habitat development plan. This plan describes the landowner's goals for improving wildlife habitat and includes a list of practices and a schedule for installation. A 10-year contract provides cost-share and technical assistance to carry out the plan. In Virginia, these plans will be prepared to address one or more of the following high priority habitat needs: early grassland habitats that are home to game species such as quail and rabbit as well as other non-game species like meadowlark and sparrows; riparian zones along streams and rivers that provide benefits to aquatic life and terrestrial species; migration corridors which provide nesting and cover habitats for migrating songbirds, waterfowl and shorebird species; and decreasing natural habitat systems which are environmentally sensitive and have been impacted and reduced through human activities. Cost-share assistance of up to 75% of the total cost of installation (not to exceed $10,000 per applicant) is available for establishing habitat. Applicants will be competitively ranked within the state and certain areas and practices will receive higher ranking based on their value to wildlife. Types of practices include: disking, prescribed burning, mowing, planting habitat, converting fescue to warm season grasses, establishing riparian buffers, creating habitat for waterfowl, and installing filter strips, field borders and hedgerows. For cost-share assistance, USDA pays up to 75% of the cost of installing wildlife practices.

Wetland Reserve Program (WRP)

This program is a voluntary program to restore and protect wetlands on private property. The program benefits include providing fish and wildlife habitat, improving water quality, reducing flooding, recharging groundwater, protecting and improving biological diversity, and furnishing recreational and esthetic benefits. Sign-up is on a continuous basis. Landowners who choose to participate in WRP may receive payments for a conservation easement or cost-share assistance for a wetland restoration agreement. The landowner will retain ownership but voluntarily limits future use of the land. The program offers landowners three options: permanent easements, 30-year easements, and restoration cost-share agreements of a minimum 10-year duration. Under

the permanent easement option, landowners may receive the agricultural value of the land up to a maximum cap and 100% of the cost of restoring the land. For the 30-year option, a landowner will receive 75% of the easement value and 75% cost-share on the restoration. A ten-year agreement is also available that pays 75% of the restoration cost. To be eligible for WRP, land must be suitable for restoration (formerly wetland and drained) or connect to adjacent wetlands. A landowner continues to control access to the land and may lease the land for hunting, fishing, or other undeveloped recreational activities. At any time, a landowner may request that additional activities be added as compatible uses. Land eligibility is dependent on length of ownership, whether the site has been degraded as a result of agriculture, and the land's ability to be restored. Restoration agreement participants must show proof of ownership. Easement participants must have owned the land for at least one year and be able to provide clear title.

Southeast Rural Community Assistance Project (SE/R-CAP)

The mission of this project is to promote, cultivate, and encourage the development of water and wastewater facilities to serve low-income residents at affordable costs and to support other development activities that will improve the quality of life in rural areas. Staff members of other community organizations complement the SE/R-CAP central office staff across the region. They can provide (at no cost to a community): on-site technical assistance and consultation, operation and maintenance/management assistance, training, education, facilitation, volunteers, and financial assistance. Financial assistance includes $1,500 toward repair or replacement or installation of a septic system and $2,000 toward repair or replacement or installation of an alternative waste treatment system. Funding is only available for families making less than 125% of the federal poverty level. The 2012 federal poverty threshold for a family of four is $23,050.

National Fish and Wildlife Foundation

Grants are awarded for the purpose of conserving fish, wildlife, plants, and their habitats. Offers are accepted throughout the year and processed during fixed signup periods. The signup periods are on a year-round, revolving basis, and there are two decision cycles per year. Each cycle consists of a pre-proposal evaluation, a full proposal evaluation, and a Board of Directors' decision. An approved pre-proposal is a pre-requisite to the submittal of the full proposal. Grants generally range between $10,000 and $150,000. Payments are based on need. Projects

are funded in the U.S. and any international areas that host migratory wildlife from the U.S. Special grant programs are listed and described on the NFWF website (http://www.nfwf.org). If the project does not fall into the criteria of any special grant programs, the proposal may be submitted as a general grant if it falls under the following guidelines: 1) it promotes fish, wildlife and habitat conservation, 2) it involves other conservation and community interests, 3) it leverages available funding, and 4) project outcomes are evaluated. A pre-proposal that is not accepted by a special grant program may be deferred to the general grant program.

Clean Water State Revolving Fund

EPA awards grants to states to capitalize their Clean Water State Revolving Funds (CWSRFs). The states, through the CWSRF, make loans for high-priority water quality activities. As loan recipients make payments back into the fund, money is available for new loans to be issued to other recipients. Eligible projects include point source, nonpoint source and estuary protection projects. Point source projects typically include building wastewater treatment facilities, combined sewer overflow and sanitary sewer overflow correction, urban stormwater control, and water quality aspects of landfill projects. Nonpoint source projects include agricultural, silvicultural, rural, and some urban runoff control; on-site wastewater disposal systems (septic tanks); land conservation and riparian buffers; leaking underground storage tank remediation, etc. Estuary protection projects include all of the above point and nonpoint source projects, as well as habitat restoration and other unique estuary projects.

EPA Environmental Education Grant Funding Opportunity

EPA has announced an exciting environmental education grant funding opportunity. The purpose of the grants is to promote environmental stewardship and help develop knowledgeable and responsible students, teachers and citizens. This program took place in 2011 and another similar round was conducted in 2012. Interested parties should keep up with the updates for coming years at http://go.usa.gov/4DQ. More information on eligibility and application materials, please visit http://www.epa.gov/enviroed/grants.html.

There is a requirement to specify an environmental issue, based on EPA's current priorities that the proposed project will focus on. There is more emphasis on expanding the conversation on environmentalism by including a variety of audiences in proposed projects.

Chesapeake Bay Restoration Fund

The fund supports environmental education and action-oriented conservation and restoration projects within Virginia's Chesapeake Bay watershed. Applications are accepted from state agencies, local governments, and public or private not-for-profit agencies, institutions, or organizations.

Virginia Tress for Clean Water

This program is designed to improve water quality in the Chesapeake Bay by planting riparian buffers and trees.

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APPENDIX A

Working Group and Steering Committee Minutes

First Government Working Group Meeting

Chickahominy River and Tributaries - Bacteria TMDL Implementation Plan Development
Government Work Group – Final Meeting Minutes
June 18, 2012
9:00 am – 11:00 am

In Attendance: Mark Alling, DEQ, Megan Sommers-Bascone (DCR), Dr. Ram Gupta (DCR), Mike Dieter (Hanover Co.), Olivia Hall (Henrico Co.), Grace LeRose (City of Richmond), James Beckley (citizen), Jody Bryant (citizen)

Meeting convened at 9:07 am. Margaret began the meeting with a brief overview of the meeting agenda and goals. She also stated that members of the Government Work Group would be evaluating information generated by the other two work groups (residential and agriculture).

Margaret noted that the results from the homework assigned at the first Public Meeting would be assembled into a list that will be given to the Steering Committee and posted on the website. Working group members may continue to submit "constraints/solutions" to the list through the end of the month.

Attendees identified the following constraints:

1. Olivia Hall – It takes a long time to get approval for permits to construct BMPs. She suggested that localities could expedite /streamline permitting so projects do not take years to initiate.
2. Christine Beish (citizen – not attending - via written comments) –
    a. There is a lack of authority for enforcement because practices in the implementation plan are voluntary. Implementation cannot be ensured. Potential solution: identify ways to make voluntary practices more desirable/digestible.
    b. Outreach and education is a challenge. There is little or no interest from the general community. Need to find the right vehicle for outreach. Stream walks are a potential tool for outreach.
3. James Beckley –
    a. Believes we can never have enough data. Money should be allocated for continuous monitoring, not just monitoring after implementation. Citizen monitoring is a great resource to obtain low cost, high quality data. Monitoring in the Reedy Creek watershed was given as an example. Coliscan Easy Gel is a potential low cost monitoring alternative; approximately $3.00/sample. It is not as accurate as a lab test but can provide a ballpark estimate.
    b. Monitoring can increase public interest and help make a connection with education.
    Can also be used to identify "hot spots".

c. Localities and or SWCD may be able to assist with seeking funds to cover associated costs. Can also utilize partnerships with localities to identify existing sewer lines, septic systems, stray animal populations, etc.
d. Local governments can encourage public outreach/education curriculum into schools piggybacking on the required "meaningful watershed experience". Providing information at public fairs and events could be also help spread awareness of WQ issues.
e. Funding sources should be identified to cover the remaining funds needed after cost-share is applied to projects. Local governments could apply for grants to help cover the costs.

Mike asked if there are nutrient credits available for farmers. Grace noted that there is no regulatory driver to install these voluntary practices therefore there is not a need for a nutrient credit program.

Ram stated that the national Fish and Wildlife Foundation is a good source of funding to cover costs associated with BMP implementation.

James mentioned that the local proffer fund that had been used for stream restoration would be ending in 2013 due to a bill passed by the General Assembly in 2008. The funds will be managed by the state and allocated on a regional scale. More information on this subject is needed for clarification. Olivia Hall from Henrico said they used to have a program for funding stream restoration and asked if the state could possible lead that. DEQ did not have an answer during the meeting.

Ram asked where citizen-monitoring data could be obtained from DEQ. James noted that this information is available on the DEQ website/online database and is considered public record. Ram also asked about the quality of the citizen monitoring data. James explained that there is a three-tiered system in place; one being the lowest quality data and three being the highest quality. There is no QA/QC conducted at level one. Levels two and three include QA/QC. Level two is used primarily for follow up monitoring and level three uses the exact protocol as DEQ monitoring and is treated the same.

Margaret mentioned that information regarding local pet waste ordinances is important as well as leash laws, etc. Established pet waste stations can be mapped and tracked using GIS. Areas of need can also be identified and ranked to help direct funds.

Funding Sources:

The discussion shifted to potential funding sources. Olivia asked if Bass Pro Shop in Ashland donates funds to environmental activities. Mike noted that the company participated in the Hanover Earth Day event. He also mentioned that pet waste cleanup companies have offered to donate bags if they are given advertising space. Mike also said that Hanover asks companies what they can personally do to reduce stormwater at their sites.

James said that Filterra might be willing to construct promotional installations of their products. Mike has also spoken with Filterra representatives about free design work.

James suggested that a portion of property taxes collected from agricultural producers could be put into a fund to cover cost share funds needed to install BMPs in additional to state cost-share. Margaret liked the idea and noted that if farmers are already paying these funds via taxes then they may be more likely to participate. An analysis could be completed to determine the revenue needed to fund this program without dramatically affecting locality operation.

Mike noted that stormwater programs need to be palatable to local officials.

Megan stated that herd health is often a topic of discussion at implementation meetings to promote the added benefits of water quality BMPs. It is important to help relate how these practices can improve production and overall health. Ram mentioned that DCR and Virginia Tech created a booklet to promote the benefits of agricultural BMPs and that farmers do not need to have personal hardship to realize the benefits of BMP implementation.

Jody suggested that the Virginia Farm Bureau be involved with outreach, education and grant funding. Megan mentioned there is also the Cattlemen's Association who could be involved.

Mike expressed his concern that agricultural practices will not offset needed reductions for urban areas. He is attempting to understand how Hanover County's MS4 permit will be affected, where the bacteria is coming from and what will localities be responsible for due to this TMDL study and implementation plan.

James questioned if building ordinances allow for LID or other BMPs. In 2014 the Bay Act will require that localities allow for these types of practices. These practices are more focused on nutrient reductions however it's possible they could be beneficial to bacteria reductions as well.

James was also concerned about maintenance of BMPs citing an example from his neighborhood of improper upkeep of a BMP. Grace stated that there are constraints with BMPs in private developments. Poor education of landowners is an issue. Localities cannot absorb problems on private lands. There was discussion that in Hanover Co., the locality is tasked to maintain BMPs in agreement with HOAs.

There was a suggestion that localities could adopt stormwater utilities similar to the City of Richmond. A stormwater utility is being considered by Henrico County.

Margaret asked what kind of mechanisms could work to solve the issue with poorly maintained BMPs on private property. Locality representatives stated that if there are no existing maintenance agreements, the localities cannot force the landowner to conduct maintenance. James suggested that the County could provide information and resources to landowners to increase education on this issue. Olivia noted that most localities have a BMP inspection program. Grace stated that accountability and responsibility for BMPs lies with the person who owns them. Maintenance cannot be forced if there is not a contract/agreement.

Mike gave a local example of how he assisted a group of concerned citizens to get a BMP issue resolved. He also said that ultimately in Hanover Co, homeowners or HOAs own the BMPs.

James suggested that localities send letters to landowners that have existing BMPs on site.

Margaret thanked the group for their comments and reviewed the preliminary estimates for BMPs. She reviewed the tables referencing the subwatershed map. She also described how the modeler runs different scenarios to arrive at the desired outcome of zero percent violation.

James asked why the TMDL is based on a 0% violation rate while the standard for listing impairment is 10.5%. Mark stated that 0% is an EPA required standard. Margaret noted that the 0% is based on a geometric mean of hourly loads generated in the model. There was discussion of the 9 scenarios and Margaret emphasized that the process requires the use of one scenario that

will achieve the required 0% standard. For this plan the modeler has suggested using Scenario 8. She also explained that is highly unlikely that every BMP included in the plan would be implemented. The TMDL reductions are conservative (there is an implicit margin of safety). Restoration of the waterbodies are determined by follow-up monitoring – not a direct comparison to the TMDL loads.

There was some discussion of how localities track issues with storm sewer overflows and sewer infrastructure. Olivia mentioned that most localities using cameras to inspect and detect issues such as leaks or breaks in sewer lines.

Margaret reviewed the estimated residential land-based BMPs needed (Table 8) and asked if the estimates were reasonable. She asked for input/conservative cost estimates for cost per unit of overflow correction. After some discussion Margaret asked Ram to submit a comment on the TMDL about changing "developed" to something more clearly to indicate the inclusion of human and pet waste in this category. Olivia noted that the cost of sewer line installation and connection would likely depend on the area of installation. She said that she could provide cost estimates.

Margaret asked the group if they would like to include an analysis of existing infrastructure and identify areas of most need. Chesterfield conducted this analysis for their infrastructure in the Richmond Implementation Plan. This may help to decipher differences among localities. Grace said that she could provide cost per foot to the main connection.

In a follow-up email, Mike provided the following from Hanover:

"For "Sewer Connection Cost" in Hanover County (this appears in both Straight Pipe Corrections and in Failing Septic System Corrections), the Hanover County Connection Cost is currently $7,838. This does not include the cost to actually do the work, just to hook up to the septic system.

For failing septic system correction, sewer connection Hanover has a recent study estimating costs to connect neighborhoods that currently are on septic to the sewage system. This involves installing sanitary sewer throughout the subdivision and connecting each residence to the system. Estimated average costs are $24,000/household. Also for this connection cost will be $7,838. Total per lot will be $31,838.

We have quite a bit of experience building /rebuilding retention ponds for the original version of Hanover County's "stormwater program". Current costs to install a pond including engineering, permitting and construction are $13,600/ impervious acre treated."

In a follow-up email, Olivia from Henrico provided the following:

"An estimate of the cost to connect an individual home to the sanitary sewer system was also requested. Assuming that there is available sewer in a street or easement along the property frontage, the cost for a County sewer lateral would be an installation cost of $3,515 plus a connection fee of $2,610 for an existing home on septic tank or $5,220 for a new home. These costs are effective October 1, 2012 in accordance with County Ordinance and may be increased on an annual basis. To summarize the cost for a sewer lateral varies from $6,125 for an existing home to $8,735 for a new home. The homeowner will also need to pay for a sewer line to be installed from the property line to the home as well as abandonment of any existing septic system. If a sewer main needs to be extended the budget cost for design and installation of such extension would vary from approximately $150 per foot of 8" line in a vegetated easement to about $250 per foot in a paved roadway. This cost assumes that pump stations, force mains and treatment plants needed to serve an area are already in place with no expansion needed. It would be expected that where septic tanks are used, then infrastructure including at least sewer mains in addition to the services would be required making the cost of connecting to public sewer much more expensive than just the cost of the service connection. The actual costs to homeowners would be expected to vary significantly among municipalities."

In subsequent follow-up emails from Ralph Claytor with Public Utilities at Henrico, the following was provided related to sewer connect of failed/malfunctioning septic systems:

"Following is a description of options to provide public sewer when septic tanks are used. Note that for a homeowner that will reside in a home that the costs for a short sewer extension and connection is less than full cost but this does not provide for significant sewer extensions into areas not currently served. Our programs do not address rural-type areas where public sewer is not readily available and septic service has been chosen to facilitate development.
DPU is not aware of any particular area that is experiencing septic tank problems.
When VDH finds a significant problem with a specific septic tank installation they will typically call to determine if sanitary sewer is available to the site. By County Code, sewer is available if it is within 300 feet of the structure to be served. If sewer is available, the VDH may require the Owner to connect to County sewer rather than issue a permit to repair or replace the septic.
Connection is at the Owner's expense.
County Code requires that sewer service be provided at the Owner's expense. Where the property is an existing single family home where the Owner resides, DPU will provide a short extension at Owner's expense as described below. Where the property is a rental property or a commercial property, the Owner must hire an engineer for design and a contractor at their own full expense. New development also provides extensions and connections at their full expense.
By County Code, DPU will provide a short extension at Owner's expense for a new or existing single family home where the Owner will reside. The maximum length of such extension is typically 1000 feet. By County Code, the cost of such extension is currently $25 per foot for an existing home plus local facilities fee plus connection fee. The connection fee is ½ of the normal

fee for an existing home on a septic tank. The cost of such extension is currently $50 per foot for a new home plus local facilities fee plus full connection fee. Where several homeowners in a neighborhood desire service, the homeowners may apply for a short extension and share the cost of the extension.
DPU does not require homes where sewer is available to connect to the sewer. DPU is ready to provide service at such time that the Owner desires to connect.
DPU does not have any programs to extend sewer service into areas not currently served by sewer. By County Code, any developer or other owner may apply for sewer service and make sewer extensions and connections at their expense in accordance with the DPU master plan.
Extensions of sewer into those areas not currently served would be provided by development in accordance with the DPU master plan and the developer, in accordance with a sewer service agreement, would donate the collector and trunk sewers to the County DPU for operation and maintenance. Note that the Virginia Code allows development of new subdivisions in these areas to use septic systems and does not require extension of public sewers."

Ram noted that the estimates for retention ponds in Table 7 are too high. Margaret stated that ponds are the last priority for implementation. She also acknowledged that there are many BMPs not yet accounted and some that lack of efficiency rates. For example, street sweeping was included in the James River Implementation Plan. Localities with MS4 permits are likely already implementing this BMP in their programs.

Margaret asked: Where do we start with SSOs? Cost and timeframe? Would we want to propose this?

Margaret asked if this is something that should be addressed locally. She emphasized that the implementation plan is intended to help localities, not hurt them. The implementation plan is purely voluntary and will be used as a baseline to help identify where work needs to be done. For example, how many fixes in infrastructure have been noted (leaks, camera, etc.). Establishing a BMP inventory in the watershed will help us keep track of what has been accomplished post-TMDL and IP.

Mike with Hanover noted that he would have to get this information from the utility department. As a follow-up, in emails after the meeting he provided that:

"Our utilities department reports that overflow incidents are 8-12 incidents/year for the past several years and the cost per incident for typical overflows are around $2000/incident. A typical incident would be one where blockage can be cleared without any excavation. Where excavation is involved costs average around $35,000/incident."

As a follow-up, in an email after the meeting Olivia with Henrico County provided the following information related to their SSO program:

"For the purpose of sanitary overflow correction and to address elements of CMOM, the County of Henrico Department of Public Utilities (DPU) maintains an Inflow and Infiltration (I&I) program. Development of this program required significant engineering evaluations to complete a Wet Weather Study and a Master Facilities Plan that included implementation of a system sewer model. We also leveraged parallel work programs that developed a county-wide GIS system and a DPU CMMS in the collection, analysis and mapping of the data described in the following paragraph.

The goal of the program is to correct I&I problems, repair damaged sewer lines, and resolve high maintenance problems. The program is designed to reduce infiltration and inflow into the system, prevent sewage overflows, limit the number of sewer main stoppages, minimize O&M costs, and provide safe and continuous service to sewer customers. The need for sewer rehabilitation projects are based on system wide wet weather flow evaluations, customer complaints, the on-going CCTV inspection program, the on-going sewer main cleaning program, and information collected during response to service calls. Methods employed to develop system improvement requirements include cleaning and inspecting sewer pipes to identify defects; pipe line repairs; inspecting manholes; flow isolation and monitoring; smoke testing; dye testing; and CCTV inspection of both existing and new sewer lines. The results of these activities and evaluations along with other data such as pipe age, pipe material, repair history, sewer backup and overflow records, and hydraulic capacity are used to identify and prioritize sewer line rehabilitation and/or replacement requirements. A summary of activities for this program is provided to DEQ on an annual basis. Data for the year ending March 14, 2012 is shown in the following table.

	Information from DPU Design for Rehabilitaion Projects
a	9.18 miles of sanitary sewer main rehabilitated by lining of pipe
b	3.20 miles of sanitary sewer main replaced
c	212 sanitary manholes rehabilitated
d	81 sanitary manholes replaced
e	1268 sanitary sewer services replaced
f	24.05 miles of sanitary sewer mains CCTV inspected and cleaned (performed by the engineering services contractor)
g	560 manhole inspections (performed by the engineering services contractor)
h	$12,670,128.00 spent on sanitary sewer evaluation studies, design and construction costs for sewer rehabilitation projects
	Information from DPU Operations
a	23 miles of sanitary sewer mains CCTV inspected and cleaned (performed by the annual contractor, Video Pipe Services)
b	29 sanitary sewer mains repaired (repairs performed by both DPU Ops and the annual contractor, G.L. Howard)
c	412 sanitary sewer service lines repaired (includes both cleanout installation and service line repair; performed by both DPU Ops and the annual contractor, G.L. Howard)
d	750 manhole inspections (performed by the annual contractor, Video Pipe Services)
e	$119,363.38 spent on cleaning sanitary sewer mains (amount paid to annual contractor, Video Pipe Services)
f	44 sanitary sewer overflows

"*Related specifically to sanitary sewer overflows, one goal of the I&I Program is to incrementally improve the system response to wet weather impacts. By 2036, this program projects that a 10 year recurrence interval storm will be contained within the sanitary sewer without overflow. The DPU Capital Improvement Program identifies projects based on the above stated criteria and projects the budget required to accomplish these goals. Projected budget needs specifically related to sewer rehabilitation and wet weather control requirements over the next 25 years are estimated to range from $400,000,000 to $500,000,000. (These costs do not include annual operating budget costs for ongoing maintenance programs.) Note that the availability of funding is subject to annual appropriations by the Board of Supervisors."*

There was some discussion about end of pipe inspections and dry weather monitoring. Olivia and Grace noted that these are already part of programs.

Margaret gave a brief overview of the Middle James Roundtable Pet Waste Social Media Campaign that stemmed from the James River Implementation Plan. The committee has been meeting quarterly to develop a regional campaign. Mike noted that he would welcome other means for increasing information in reporting. The County currently distributes flyers for pet waste as part of their MS4. In a follow-up email, he stated:

"Cost for a mailing which includes printing and mailing costs is around $0.46/household."

Margaret briefly reviewed the maps noting potential areas in need of stream fencing. She emphasized that these maps are merely suggestions and will be reviewed during the Agriculture Work Group meeting to refine the estimates. Jody asked if stream fencing was the primary BMP initiated (i.e. – Stream Fencing was put into the model and then it was determined how many other BMPs were needed). Ram and Megan noted that there is a suite of BMPs used for agriculture but stream fencing is the most commonly used because it is very effective at removing a direct source of bacteria. Megan emphasized that Soil and Water Conservation Districts are an invaluable resource for local knowledge of agriculture trends.

Grace asked if the implementation plan could be broken down by jurisdiction similar to the James River Implementation Plan. Margaret will ask the contractor if this is feasible. James suggested we obtain numbers from locality animal control programs to determine where stray animals are an issue.

Margaret thanked everyone for his or her attendance and participation. She mentioned that meeting minutes will be distributed to the group in draft form and she encouraged members to submit edits to improve the notes. She plans to send out a Doodle poll for the next meeting.

Meeting concluded at 11:02 am.

First Residential Working Group Meeting

Chickahominy River and Tributaries - Bacteria TMDL Implementation Plan Development
Residential Work Group – Final Meeting Minutes
June 18, 2012
6:00 pm – 8:00 pm

In Attendance:

Megan Sommers (DCR – meeting scribe), Margaret Smigo (DEQ – meeting facilitator), James Beckley (citizen), Lynn Wilson (Henricopolis SWCD/citizen), Christine Beish (citizen), Robin Wilder (citizen)

Meeting convened at 6:04 pm. Margaret began the meeting with a brief overview of the meeting agenda and goals followed by member introductions.

Margaret noted that the results from the homework assigned at the first Public Meeting would be assembled into a list that will be given to the Steering Committee. She reviewed comments submitted by members in response to the homework assignment.

Attendees identified the following additional constraints:

- Limited opportunity for residential scale BMPs because of building codes and/or Homeowner Association Standards. Geese management and grass cutting standards is an example.
- Some localities have nothing in their building codes to require low-impact development practices (ex. rain gardens, cisterns, etc.). This could potentially be a roadway/right of way issue. These practices should be incentivized.
- The County owns and operates drainage areas but they are not being maintained.

Margaret asked for solutions to the aforementioned constraints. For example, MS4 localities could include LID as part of their permit. There was discussion over why these practices are not being implemented currently.

Potential solutions:

- Opportunity for homeowner audits to summarize individual impacts and potential improvements. Examples of existing programs include the District of Columbia and the Alliance for the Chesapeake Bay's work in the Reedy Creek watershed. Brochures could be included with the annual water quality report. It was noted that neighbor to neighbor promotion of BMPs is essential and information should be uniform across the watershed.

Margaret mentioned the programs initiated by Hampton Roads Planning District Commission to address BMP implementation (ex. HR Green, etc). The Richmond area does not have as much support for regional approaches to issues.

It was noted that localities need to be shown the benefit of incentivizing BMPs. Soil and Water Conservation Districts could be a good means for educating and highlighting positive actions by homeowners, similar to the James River Association's River Hero Homes program. Media

partners could be beneficial to highlight stories about local waterways. A "Yard of the Month" competition was suggested. "Neighborhood of the Month" was also suggested. Friendly competition between neighbors and communities could encourage public participation.

The following media outlets were suggested for outreach efforts: WRIR, WRVA, the Henrico Citizen, and North of the James. Homeowner Associations (HOA) are another potential means for communicating homeowner BMP implementation. Localities should have information on HOA contacts. If this information does not exist the District could utilize an intern to compile the list.

Alternative Funding Sources were discussed. Randolph Macon College's environmental science program is active in the community and has an annual project for student volunteers. Master Naturalists, Master Gardeners and outdoor outfitters were also mentioned. Corporate sponsorship from businesses in Innsbrook could be a means of funding. The proffer discussion from the Government work group meeting was mentioned. Money could be set aside to maintain BMPs and localities could be given authority by the General Assembly for enforcement.

Margaret gave an overview of the BMP estimates in the pamphlet. She noted that the developed category includes humans and pets. 100% of human sources are listed first because there should not be any human waste contributing to the problem. She also mentioned the difference between the violation standard used by the state to list impairments (10.5% - Single Sample Maximum Standard) and the 0% standard used by the model (geometric mean). Modeled violations are different because simulated values fill in the monthly or bimonthly "single sample" with hourly values, therefore a geometric mean can be calculated. The model generated conservative estimates. It is unlikely that all BMPs included in the plan will need to be implemented to meet water quality standards. A phased approach will be used to implement BMPs. Generally, the timeline for Implementation includes the more desirable/cost effective BMPs initiated first, and those more difficult or costly to implement later on. More recent cost estimates on some residential practices would be appreciated by those who could provide them.

Buffers were suggested to promote/facilitate homeowner actions. The group discussed ways in which buffers might be incentivized. Rain barrels can be implemented in residential areas because if downspouts put rain into the yard and there if dog feces are on the ground surface, it can be carried in the runoff to the waterbody.

The group discussed wildlife sources. The IP can promote wildlife management through education ("do not feed wildlife" signage, handout materials, etc.) however it isn't possible to include BMPs to "reduce wildlife" nor could it include "wildlife management" plans itself as those fall under the purview of DGIF. DGIF can be consulted, especially in instances of nuisance wildlife populations, and it is they who may make recommendations. It was noted that some BMPs suggested may have the side benefit of deterring resident geese (vegetative buffers can be used to avoid attracting resident geese because it makes it more difficult for them to come ashore).

A member asked what the difference was between a bioretention basin and a raingarden. Margaret said her inclination was that a bioretention basin was a much larger, engineered raingarden. Later, in a follow-up email, Margaret provided this expert from the James River – City of Richmond IP developed in 2011, which explains that bioretention basins are:

"Bioretention Facilities Level 2 Design, are excavated areas backfilled with a sand/soil mixture, planted with native vegetation, and used to detain, filter, and infiltrate water. They can be located in median strips, parking lot islands, unused odd areas, and easements usually less than 2acres in area. Implementation of bioretention basins could reduce runoff volume flowing into combined-sewers by detaining, evapotranspiring, and infiltrating water. A bioretention facility with an underdrain system is commonly referred to as a Bioretention Filter. A bioretention facility without an underdrain system or with a storage sump in the bottom is commonly referred to as a Bioretention Basin. Small-scale or Micro-Bioretention used on an individual residential lot is commonly referred to as a Rain Garden."

An error was noted in the number of units necessary for the "vegetative buffer", for both the residential and agriculture tables in the worksheet. This was later clarified and the worksheets have been updated. The corrected worksheet will be posted on the DEQ website. In the residential veg. buffer estimate, the modeler assumed that of the 8000' feet of stream available, a ¼ of that would receive veg. buffers, equal to 1.4 acres total. With respect to what areas would be most benefitted by vegetative buffers, the modeler said that he would look at areas to target, based on sources in subwatersheds with regard to landuses and reductions required to them, and get back to us. He said that when developing IPs, he likes to leave it up to the stakeholders to determine whether or not vegetative buffers would be a successful BMP in any given watershed, so he tends to start on the low end of estimates for these. We can most certainly increase the amount of vegetative buffer. In the preliminary BMP estimates the vegetative buffers are assumed to be 30' wide.

The vegetated buffer on cropland (Table 9, which is one of the ag-tables, which says 0.11 acres) should be corrected as well. We actually used 5000 ft in the model, or 3.4 acre. These changes have already been made in the government and agriculture handouts which are to be posted on the DEQ website.

Margaret mentioned that rain barrels, cisterns, permeable pavers were not included in the initial recommended BMPs although these are practices that could be included and targeted at residential areas within the watershed. Portfolio of homeowner practices could be created.

Margaret reviewed information on sanitary sewer overflows (SSOs) and how localities track problems in their systems. James noted that citizen monitoring near sewer lines crossing rivers could help identify problem areas. Megan will check to see how citizen monitoring has been included in other IPs.

Amoung additional topics of discussion:

Schools should be involved to provide a meaningful watershed experience within the watershed. BMPs at schools could be used as "teaching tools".

Localities could recruit local citizens for water quality monitoring at community events.

Margaret explained the schedule for upcoming meetings (general timeframe). James asked about having a collective meeting of all working groups prior to the 1st steering committee meeting. Margaret said that she would discuss it with the contractor but she could not guarantee that it will be feasible (contracts, deadlines, etc.). The Steering Committee meetings are where the working group representatives discuss all of the ideas developed and proposed during the 1st and 2nd working group meetings. In order to have an additional meeting as suggested, there should be a necessity. At the present, it is not apparent that it would/wouldn't be. Anyone that would like to attend all three WG meetings is welcome to, and anyone who'd like to join the Steering Committee may do so as well.

Finally, Margaret briefly reviewed the stream fencing maps and noted that the agriculture work group will review this information in more detail. If the WG members would like to comment on any of the Ag-BMP preliminary estimates they were welcome to do so.

The meeting concluded around 8pm.

First Agricultural Working Group Meeting

Chickahominy River and Tributaries - Bacteria TMDL Implementation Plan Development
Agriculture Work Group – Final Meeting Minutes
June 26, 2012
2:00 pm – 4:00 pm

In Attendance:

May Sligh (DCR – meeting scribe), Margaret Smigo (DEQ – meeting facilitator), Ram Gupta (DCR), James Beckley (citizen), Barbara McGarry (Henricopolis SWCD), Kemper Marable (Henricopolis SWCD), Sharon Conner (Hanover – Caroline SWCD), Marian Moody (Hanover – Caroline SWCD), Patricia Edwards (Citizen, tree-farm owner)

Meeting convened at 2:05 pm. Margaret began the meeting with a brief overview of the meeting goals and agenda followed by member introductions.

Margaret noted that the results from the homework assigned at the first Public Meeting would be assembled into a list that will be given to the Steering Committee. She asked if anyone would like to discuss constrains/solutions.

Attendees identified constraints/solutions regarding ways to identify stakeholders in the watershed by utilizing: biosolids permit info because each permitted farm must have a NMP for the application, tax-map data for localities using Ag-zoned properties to contact land owners, homeland security (some chemicals of certain quantity in ag-application are tracked and this could be a resource), slaughter houses could share information on their clients, work with districts using GIS Arial photography and infrared layers to correct land uses and identify potential areas where we'd want to contact land-owners to participate in BMPs (search for pasture areas, fencing/lack of fencing, chicken/hog houses,etc.). Additionally, stream walks could identify BMP opportunities. James discussed a project he was involved with as a citizen volunteer working with a Soil and Water Conservation District where volunteers walked teams and documented issues with photography (could also take lat and long with readily available technology).

The group discussed how we might reach the audience, especially horse owners as there are a lot of horses in the watershed but most don't qualify for cost-share and the experience of SWCDs is that the horse community is not interested in participating in cost-share program. It was suggested that we work through farriers, horse clubs, and veterinarians to get the word out.

In the watershed, there has been an increase of "homesteads" or small farms where folks will get a few chickens and goats and they multiply – in Hanover overall beef populations are downward trending. SWCDs stated that they've participated at many different events but they've not been successful at getting anyone to sign on to any particular practice at the event.
With regard to alternative funding sources, James mentioned his idea of the counties setting aside a portion of ag-zoned property taxes to help farmers with their portion of cost-share – when their portion is too much for them to afford. An example of this was that Hanover-Caroline said the average grazing system costs around $50K, and the farmer portion would be $12500K – which is discouraging to a lot of farmers. Henricopolis mentioned they don't have the same needs for stream fencing in their portion of the watershed and haven't had a single stream exclusion system installed as far as they were aware.

Margaret asked if there was any type of special "fencing funds" perhaps through the counties. To everyone's knowledge, the localities do not currently have any special fence-funding program.

Barbara mentioned in Henricopolis, they won't be getting any TMDL costshare dollars at least until 2014. Margaret said this is important to note in the IP.

There was a brief discussion about fencing estimates regarding the fact that the Land Use used to indicate "Pasture" is from 2006 – the most recent available. Henricopolis felt there was a lot of pasture indicated on the maps that may actually be developed areas and overall the estimated fencing in their district was overestimated. Margaret gave the maps out in the beginning of the meeting and there were a lot of questions and concerns. Margaret asked the group to hold off on that discussion until she gave a little more background regarding assumptions and details on how the maps were derived (in second half of meeting) and asked the group to first finish discussing items/questions on the bottom of the first page of handout, their input on these bullets will be beneficial to the overall IP development.

Margaret asked the groups what the education needs were in the watershed. The group returned to the issue of reaching the horse enthusiasts. The SWCDs have held "horse extravaganza" type events but little success with sign-up of BMPs. James suggested working through farriers or veterinarians/trainers. One problem seemed to be that there was only one BMP available for horse owners – for waste storage, and horse operations don't currently quality for other cost-share BMPs. It might be beneficial to consider including voluntary BMPs for horse owners in the IP, should funding be made available, especially since they are so prevalent in the watershed.

Margaret gave an overview of the TMDL conclusions in the pamphlet (Tables 1 – 2b). Table 1 shows the subsheds that had impairment for bacteria and were being evaluated for different types of source reductions (where sources are direct and indirect bacteria sources from wildlife, livestock, humans, and pets over different types of land uses). Table 2a describes the scenarios by which allocation of the streams in Table 1 were evaluated, where scenario 8 was the final TMDL scenario. Margaret spoke a little bit about the rationale the modeler uses when going through each scenario, for example, typically right off the start, the modeler will reduce 100% of human sources first because there should not be any human waste being discharged into the watershed (it's illegal). Margaret also explained that in a watershed approach, allocation is done to the impaired watersheds to identify what scenario gets us to a 0% violation rate, then that scenario of reductions for each source type is applied to each subwatershed. Depending on what is actually in each subwatershed (looking to our population estimates) it may be that for some source reductions, we are already done. Margaret asked the group to turn their attention to Table 2b which gives the detailed evaluation, which involves reducing different source types within watersheds in order to see what effect it has on % violation of the water quality standard. She explained what each column represented with regard to source types. The table is useful because you can see where some reductions were more successful for some more than other source types. This would indicate where some BMPs may be more beneficial than others, and can guide us during Implementation Planning.

The group next discussed Table 3, which were the existing BMPs from the DCR Ag-database. Kemper asked if these could be filter by county, others thought so and that there should be enough information to identify to subwatershed level. Kemper suggested that the tables include a

column for county which would make it easier for SWCDs to determine which of these practices were in their districts.

Margaret explained how the maps for stream fencing were generated (text on page 6 of handout) and asked group if they thought Option 1 or 2 was more accurate estimate on amount of stream fencing needed. Where option 1 only included named, perennial streams, option 2 (which is in addition to option 1 lines) included the un-named perennial and intermittent streams. The two lines together (orange and pink) equal the stream fencing values in option 2 (Table 4). The more streams you include and depending on their proximity to 'Pasture', the higher your estimated stream fencing will be. She said that it's possible to do an additional scenario where we get in between these numbers (taking out "intermittent" for example, from option 2, would reduce the stream fencing needed). Sharon mentioned they do cost-share on intermittent so she thought it only made sense to include those streams for fencing. Patricia didn't understand why it would matter if you removed one over the other. Margaret stated these estimates are a starting point only – and DEQ didn't expect the number generated for stream fencing to be perfect because it's not feasible to ground-truth every "pasture" acreage identified in the maps. She thought as a start, SWCDs might first to be to look in areas in the maps where you expect higher densities of developed lands and make a judgement call as to whether or not the amount of "pasture" in the maps was accurate. If you are reasonably certain it isn't there – nix it and call it "developed" or "residential", etc., whatever you think is most correct for that location. It would be helpful to the modeler, to tell him if what we think the land use is, if we don't think it is pasture. Ultimately, changing land use in the model will change the types of bacteria that are applied to different land uses, and therefore change the types of BMPs needed in the IP. Margaret volunteered to help SWCDs look at aerial photography as well to do these land use adjustments. She made it clear that it was not her or DEQ's expectation for anyone to have to do watershed surveys to correct these estimates. That would be too costly in terms of time and resources, and getting the number exact was unnecessary.

There seemed to be an agreement that stream fencing would be necessary for horses, not just cattle and perhaps it would be necessary to quantify estimates for each type, since horse fencing would not qualify for cost-share.

There was a question about placing fencing on intermittent streams and whether this would conflict with cost-share or if we didn't put in enough stream fencing, whether that would prevent SWCDs from obtaining funding. For example, if IP said we only need 100' of fencing, and they really need 1000', would this actually be a hindrance for the SWCD? Margaret said she didn't think so, but it was more likely that we would overestimate the number needed because the TMDL was conservative.

Henricopolis asked that DEQ/Maptech include columns for "county" on all tables – again it would help them decipher between districts easier.

There was confusion in Table 4 about what "Cost Share Fence Installed (ft)" represented. If this represented existing stream exclusion, it was not included in Table 3. Margaret said she would rectify this with the modeler, but couldn't say for sure at the time whether it was left out of Table 3, or whether it was an error in Table 4. She will get back to the group on this question.

Henricopolis already mentioned they had not done any stream exclusion in their district, and Hanover-Caroline didn't say if that number looked right for existing stream exclusion.

Henricopolis mentioned the maps provided were too small for them to work with. Margaret said she pulled them out of the booklets to make them bigger, but it wasn't necessarily the intention for them to only work with these maps. She would like to share with them the shapefiles if they'd like to work with them in GIS – they all agreed this would be best. Margaret would ask the modeler to make them available and provide to the districts.

In a follow-up email, the modeler provided 'pasture' and proposed 'fencing' shapefiles. The shapefiles shared were a more simplified version of what was shared in the handouts. The explanation of how the shapefiles were simplified and how this affected pasture and stream fencing, is explained here (from Mohammad Al-smadi, modeler, Maptech-Inc):
"I went over the aerial photos of the watershed and adjusted the fencing based on what I thought was or was not pasture. In some instances, GIS generated fencing was removed and in other, more fencing was added. All in all, the proposed fencing length after this work is a total of 128,000 linear feet. This is over double the initial estimate when only the named perennial streams were used but about half of that when all streams were used."
At the time these minutes were finalized, DEQ and the modeler were continuing to work with the districts to arrive at the best estimates possible for stream fencing.

Regarding the questions on page 8, the group didn't feel comfortable commenting on whether option 1 or option 2 was better, and didn't say whether an intermediate (i.e. - remove "un-named perennial" or "intermittent") would be helpful. Ultimately, an answer will be needed from the group regarding how much stream fencing is needed for the project, otherwise DEQ/modeler/DCR would have to make a judgement call on an appropriate number. Margaret said the group has time to work on this and we can discuss more during 2nd WG meeting, however, we shouldn't be waiting until this meeting – we need to be actively discussing/working toward a better number between meetings.

There was no comment on the # of systems needed each for SL-6, LE-1T, LE-2T, or WP-2T, and the group was unsure if the 7% maintenance reserve for stream fencing was adequate.

Margaret asked the group to look at page 9 in order to discuss the preliminary estimates of BMPs needed, based on the TMDL in order to meet 0% violation of the water quality standard. The model generated conservative estimates; therefore it is unlikely that all BMPs included in the plan will need to be implemented to meet water quality standards. A phased approach will be used to implement BMPs, and generally, the timeline for Implementation includes the more desirable/cost effective BMPs initiated first, and those more difficult or costly to implement later on. This is particularly important with regard to retention ponds – which everyone agrees would not be a desirable BMP to implement. Margaret also mentioned that it's likely if we increase the numbers of more desirable BMPs, as well as update the land use (Pasture), we may need fewer of the less desirable BMPs to meet water quality standards in the model. Margaret mentioned ultimately, it's not the TMDL or IP that tells us we've done our job and restored water quality, it will be the water monitoring we perform. If we meet the water quality standard in-stream, then the stream can be delisted and technically, are not required to do any additional work.

The group evaluated Table 7, and Ram mentioned that what is on Table 3 and missing from Table 7 was FR-1 practices, and that we should add those to Table 7. May followed up later in an email with Margaret that in the recent Upper York IP, they focused on 3 cropland practices which were appropriate in their benefit towards reducing bacteria: permanent vegetative cover on cropland and FR-1.

Sharon said we should include cover crops, if it is allowed.

Barbara said a better cost estimate for both types of retention ponds in Table 7 would be $8-10K.

Sharon, in a follow-up email to the meeting, mentioned that average costs of grazing systems in Hanover-Caroline SWCD were $23,155.00 for 26 SL-6 grazing systems over the last 10 years in Hanover and Caroline Counties, which is approx. $6.40 linear foot of exclusion with grazing land management. These numbers were based on smaller systems with approximately 3, 625 linear feet per system.

SWCDs mentioned they prefer seeing prices in "feet" as opposed to "systems" for the unit. Margaret mentioned that for the reader, it is probably easier to see in terms of systems, because that would incdicate how many farmers you would need to approach to install these complete systems – versus putting something like 45,000', which is kind of abstract in a large watershed. She would ask the modeler if both estimates – systems and feet, could be included in the tables.

Sharon questioned whether farmers who applied for conservation tillage – cropland, had to also have an animal operation affiliated in order to qualify. We were unable to answer this during the meeting, but in a follow-up, Ram provided that yes, they would still qualify. The remaining question was whether or not this practice – if not affiliated with an animal operation, would be beneficial at reducing bacteria. If not, then it doesn't seem practical to increase the number of these systems in the plan, although, they would be beneficial at reducing sediment and nutrients. At the time these minutes were drafted, the modeler had not yet responded.

Margaret explained that in the original iteration of the Government WG handout – which was sent to the SWCD folks a week prior, contained an error regarding the number of units necessary for the "vegetative buffer", for both the residential and agriculture tables in the worksheet. This was later clarified and the worksheets (including the current Ag WG handout) have been updated. In the residential table, the preliminary estimates are based on assuming that ¼ of the 8000' of streams would need vegetative buffers resulting in 1.4 acres. In the agriculture table 7,

she asked the modeler what the total footage was for vegetative buffers on pasture. At the time these minutes were drafted, the modeler had not yet responded, however, in the meeting, Margaret said that he assumed 5000' would need vegetative buffers, resulting in 3.4 acres, therefore, that 5000' is most likely a 1/3 or some portion of the total available stream footage available for vegetative buffers on pasture land. The modeler will provide a mechanism to help WG members see which subwatershed might most benefit from vegetative buffers.

Margaret explained that in the preliminary BMP estimates the vegetative buffers are assumed to be 30' wide. The preliminary estimates were kept low, because efficiency-wise they aren't the most effective BMP at reducing bacteria although they are very beneficial to the watershed at reducing nutrients and sediment (multiple benefits which the model is not able to capture). The Working Groups/Steering Committee may increase the number of units if they so choose.

Sharon asked if the 10' buffers could be used in these areas (Bay Act).

The group indicated they preferred including buffers as a part of stream fencing (LE-1T).

Margaret explained the schedule for upcoming meetings (general timeframe), and a doodle poll would be sent to set up the next set of meetings. If anyone prefers to just let Margaret know when they cannot attend, they could skip the doodle poll. Margaret explained that if you go to the doodle poll and NOT select any dates/times that will incorrectly tell her you can't attend any meetings. If you do the doodle poll, you should select the times you can attend. The doodle poll is expected to be out by July 9th or that week for end of July or first part of August.

The meeting concluded around 4:45pm.

Second Agricultural Working Group Meeting

Chickahominy River and Tributaries - Bacteria TMDL Implementation Plan Development

Agriculture Work Group - Second Meeting
August 20, 2012
9:00 AM – Noon

In Attendance: Margaret Smigo (DEQ), Kelley West (DEQ), Megan Sommers-Bascone (DCR), James Beckley (citizen), Leigh Pemberton (Hanover-Caroline SWCD and farmer), Marian Moody (Hanover-Caroline SWCD), Ram Gupta (DCR)

Meeting convened at 9:05 am.

Margaret gave a short introduction regarding the group's purpose, reflected on previous work with the TMDL, gave an update on the public comments received on the draft document, and gave a quick synopsis of the group's agenda. The group's main task was to review the revised BMPs proposed and comment on numbers estimated and costs.

Sharon C. thinks Table 1 is not county wide. Hanover has their BMP's that have already been installed in a GIS layer and should be able to pull what was in the Chickahominy but the BMP's from 2012 are not included. We can ask DCR to map out the database. Ram says the numbers on the table are pulled from HUC codes, and that Muhammad pulled all of the BMP's, not just bacteria BMP's. Someone commented that if Table 1 are county wide, numbers are really low. (*As a follow up – it was confirmed that current BMPs implemented in Table 1 of the handout are specific to the Chickahominy River watershed and are not County-wide numbers*).

Table 1 corrections- Nutrient management should be included in the table; Megan S. can talk to John (NMP at DCR) and see if people actually apply those practices to farms. Leigh P. follows the NMP closely on his farm, and says you can't keep to it exactly but you follow it. If you spread manure you have to pull a soil test, so following the plan makes you have to get manure to all the fields. Most farmers abide by the NMP's; you have to average your fields so it might not be as accurate as the plan states. Someone suggested we should try and pull data for Nutrient management that is applied to manure only. Ram G. stated if this efficiency is listed for bacteria reductions then we can use it in the IP model. There are some you can leave off such as integrative pest management, stated a SWCD person. There was a discussion by email about cover crops and permanent vegetative cover crops prior to the meeting. Someone mentioned that would be a conversion from cropland to hayfield landuse. As far as cover crops are concerned they should be included especially for those spreading manure, and if it's fallow. There has been much conversion in Hanover. New owners change the use from cropland and add pasture and horses. James B. said this can be a problem because we are increasing bacteria. There is only one dairy in Hanover County in the watershed and he would not change the cow location. James B. asked if there any way cost-share could not support that practice, or add additional requirements to the cost share. Someone mentioned the DCR program does not allow for specific stipulations.

Margaret S. - if there isn't a known or derivable efficiency then we can't put it in the model, if we still want the practice even though there is no efficiency, then we can put it in the text and promote the practice. Sharon C. stated that cover crops will be a good one to include as promotable if there is no bacteria efficiency available.

Ram G. said we need to include the projects that cost share will apply to in order for farmers to be able to take advantage of them. We can include "good practices" but there may not be cost share money available for them.

James B. - How far back does this table 1 cover? Margaret assumed that Mohammad pulled whatever was in the DCR BMP database. Ram G. said it can be pulled from all of the database and that the contractor should be able to pull the dates, and he can figure out what BMP's were used most in the past 10 years in specific hydrologic units of the watershed. Most BMP's have a life span of 10 years. Soon the database will have some percentage of BMP's that are no longer effective. James B. thought we should include the effective BMP's for bacteria. Sharon C. said Hanover hasn't had a situation (at least not frequently) in the county, where ineffective BMPs were established or BMPs were abandoned every practice put in is still there and useful. James B. thought we should not include necessarily all of these previously installed BMP's because most of them may no longer effective. In response, Sharon C. said even if some of the BMP aspects may be broken they will or may still function or provide the intended service.

Ram G. stated these BMP's are designed for a specific pollutant and we need to focus on what BMP's are required for bacteria reduction. Most of the contractors look at the inventory and select a few BMP's that have the most effective reduction. We need to include BMP's with the highest efficiency and focus on those.

Megan S. said if the districts are saying they don't have a particular issue with one practice, then we should go with what they see and say.

Margaret S. said in the James River IP we had promotable BMP's in 3 categories easy, medium, and hard and the details of each practice, but there were no efficiencies for it and that was made clear. This allow stakeholders to reference the need in the document even though it isn't a quantifiable bacteria reducing BMP. We can include that kind of a table along with text in this project as well.

STREAM Fencing

The new numbers were determined by Mohammad, after overlaying aerial photography and Land Use. He corrected "pasture" land use using updated aerial photos and changed it to what was more applicable. Margaret explained that in a conference call with DCR and the SWCD after the 1st working group meetings, SWCD folks agreed the new fencing numbers were the best we could come up with for now.

We plan to include some text from the Hanover-Caroline SWCD about their pilot program which will ultimate provide updated numbers of livestock populations and actual pasture/cropland areas. This can be used to adjust actual needs in their portions of the watershed.

Ram G. mentioned in the conference call that there was also an agreement that Mohammad would separate out the "perennial" vs "intermittent" stream fencing feet needed so that the districts could prioritize. Margaret agreed, that would be provided to the districts but it would not be included in the tables. Districts can only put in stream fencing if there is an impairment. There was much discussion that followed. Ram G. was very adamant that we should list separately which streams are intermittent or perennial, because there is no way for the districts to find out which streams can be fenced and which cannot.

Margaret S. said she thought Mohammad can pull and have numbers for perennial and intermittent. But we will not have the distinction in the IP, we will just include all of the streams in one value for fencing. Sharon C. said that was fine because the county will know when they go out which it is. Megan S. asked do we ever separate out 2 streams in other IP's? Margaret said we have not separated the two before but she wasn't sure that we included "all streams" before, it might have only been perennial.

Sharon C. explained that when the linear feet of fencing is counted we include perennial and intermittent and put it as one total in the DCR database. The other fencing that is put in which is not streamside, that is not included. However, if its exclusion fencing then all of it is included as long as you have an impairment (sum perennial and intermittent installed). Margaret S. reiterated we could include verbiage related to how the numbers were cacluated and we could also probable state "x" perennial and "x" intermittent but we prefer to keep them together as one sum in the table.
Ram G. stated it's important to keep them separate because bacteria efficiency is based on permanent or perennial stream – the efficiency for an intermittent stream could be different.
Margaret S. didn't think the stream had to be perennial to be effective. Ram G. responded the BMP will be more efficient on a perennial stream because it will be used all year as opposed to just a few months. Leigh P. stated that he didn't think the numbers should be separated because cattel will go on their path no matter what.

Marian M. said if it's a dry ditch then farmers will not fence it due to loss of pasture, intermittent streams that look perennial will be fenced out, however. Farmers are already upset that they are losing farm land to buffers. They are not going to fence out ditches too.

Margaret S. said if the literature on efficiency suggests that it would be less efficient on intermittent streams, we could put something in the text about the efficiency will be slightly less for the intermittent parts, but we are including them because the fencing will be put up regardless. There is a possibility we could adjust the efficiency for the intermittent streams and will check with Mohammad on that possibility. We'll need an "intermittent" fencing efficiency or we'll have to adjust the one for perennial fencing to be a certain percent less effective.

Sharon C. stated stream exclusion fencing is reported as W2 by linear ft. SL6 is reported by acreage because it's a system. Margaret S. said she thinks Mohammad did not distinguish the numbers per fencing system because he might not have known which ones to include/or not include in this project. Ram G. said the number of systems looks very low, and the system cost should also be $20-25,000 per system.The cost will be listed separately for the systems, but most of the times the two systems will be done together.

Sharon C. asked about the "840 ft" in a system, it's all over the place for numbers, so it would be hard to tell. If the SWCD did not install, 148 systems, would that be a problem?
Margaret S. said she didn't think the number of systems would matter, it's the "feet" needed that you will go by.

James B. said we should remove streamside fencing systems and have cost per foot instead, depending on how you look at it, there is a huge difference if you calculate it by linear ft or by system amount. Sharon C. said that amount includes everything averaged out - even crossings and wells for a system and it should not be interpreted as the fence cost only.
Ram G. stated the estimate of $6.40 is way too high, that includes the cost for everything, that should be system cost not foot amount.

Margaret S. said when contractor put in amount for maintenance he just put the amount for the system, not for just the fence itself.

Someone mentioned the fencing estimates should be broken out by incremental amounts, not as the total system. James B. said the number are pretty close on the two amounts(James IP fencing and Chickahominy amount). Margaret S. asked the group if they would like to keep the estimate as $6.40? Marian M. asked if we just want to have numbers for the fencing? She stated there is a need to have the amounts broken out for all of the systems, and types. Sharon C. said it would help if we just look at linear ft but Marian M. said it could mislead people into thinking it's for fencing only and not all parts that are included in the overall practice. Margaret S. suggested we could make that clarification in the text. Leigh P. said if you do the math, the figure in the chart is higher than what Sharon said, its more like $9.29 per linear foot.

Ram G. suggested that we need to separate out the systems and it will make a big difference, you can have the amounts broken out for each type. Margaret S. said we can break out the 2 systems but we may need information in order to do it – or it may just be done 50/50.

Ram G. stated Maptech has done this in many IP's, so they easily be able to break out an estimate between the two types - they already know how to do that.

Sharon C. said she was good with the stream fencing estimates, they may be high for a cattle system, but not for a horse system.

Ram G. suggested we should use the James River IP as an example, the number Keith burgess came up with is better than what we currently have. The counties are similar so we should use that.
Sharon C. commented they didn't do le1t and le2t in their district.Megan S. said those two are included because they were TMDL watersheds. The Le2t there is a difference between the distances of buffer; its only requires a 10% buffer and gets 50% cost share. Sharon C. said LE2t will not be applicable because of the Bay Act (35 ft required buffers) however Ram G. said we should leave it in but have text saying it would not be applicable, but if we leave it in then the option will be open should the need ever present itself.James B. said we should not mention LE2t and just say that is for other fencing. We should say 95% will be SL6 le1t and 5% for other fencing such as LE2t (reference sentence 5-20 from James IP).

Margaret S. reiterated the discussion and issue of addressing loads from recreational horses (not on a farm and therefore don't qualify for cost-share).

Table 4
The group felt the table title was very confusing, and asked if we could put "population" under the headings for animals. Margaret said we can put in the text that cost share might not be used for horse population but we wanted to include them because it's hard to tell the difference between horse and cow "pasture" uses, and stream fencing estimates are based on where "pasture" land uses and streams cross.

Ram G. said you have to be careful because the cost of fencing for beef and horse will be different. There should be separate costs estimated out for each. Margaret S. reiterated the discussion between DCR and SWCD the week before. Henricopolis might have a way to pull out the information to determine the horse fencing, but she might not have time to do that. Do we want to break out horse

fencing for Henricopolis district alone? Hanover/Caroline said they can't do it and Henrico will have a pretty small amount. Hanover/Caroline SWCD said right now it's not feasible to break the difference between horse and cattle amounts although their pilot program should give us the numbers needed. Sharon C. said fencing needs will be less horses per linear ft compared to cattle, the money would be given to cattle because there would be more bang for their buck since there are more cattle than horses. Most of the larger horse operations have a brood mare part and they would qualify for more cost share money because they are selling a product. Margaret S. said the only way to separate the recreational horse number from cattle is if someone can tell Mohammad what pasture would be horse only, unfortunately, no one is able to provide that at this time.

Table 5

Margaret S. said that by adjusting the fencing number we were able to remove a lot of the retention ponds. During the call between DCR and SWCD the previous week, a "new" BMP for rental equipment (drill) was discussed. Margaret said the discussion was that Henricopolis thought that a purchase some sort of equipment would make the waste management part of a practice more desireable because many don't have access to the equipment and it could be rented to those wanting to do the practice. Margaret had asked the district to work with DCR (May/Ram) to decide if that practice could be included or not.

Sharon C. said horse manure is the main complaint in the county, and the district could put in the horse composters in each farm. There are specs out there for smaller systems. 3 stalls and manure gets moved from one stall to the next with small equipment. There would be no funding for that because the cost share composters (NRCS composter specs) require roofs and concrete and it gets way too expensive, they over design for those. We are hoping to get a grant for these small individual systems. The $3000 amount came from Keith B. during an Ag-WG meeting and that was for 3-5 horse system.
Ram G. - The system number is high; we should look at the James R. IP, those covered about 2000 linear ft per system. Margaret S. asked if the group wanted to use another estimate?
Sharon C. said the $7800 figure would cover any system we have to put in. Margaret S. said if you multiply it by 3 it will be close to the James River IP figure, so there's little difference between the two. Ram G. said the cost is never estimated this way, all in one, it's usually broken out. James B. said if we rounded up to $10 per linear foot then it would be a little closer to the James R. IP and it would be a rounded number.

Ponds

Sharon C. said a typical practice would be 8540 ft, for $8.50 per cubic yard moved. So $8540 would be per system. Margaret said that Mohammad needed the figure in Acres treated, not acres constructed. James B. said the figure will vary per system. Sharon C. said they base it on the amount in the watershed not landuse. Hanover does not put in ponds because it's so difficult, it's a logistic nightmare.
Ram G. said ponds would only be included in phase 2, in all IPs there has been no cases where we have had to implement those. Sharon C. said these ponds are based on a standard dug pond for runoff, for $8040. That's realistic and it has to be engineered. Sharon C. said its site specific and the only pond we know of was going to be over $100,000 put the damn back for a 200 acre treatment of the watershed - and was just for the damn back.
Marian M. said you only have a 3% slope so the ponds will drain a lot of watershed – that is also something to consider. Sharon C. said ponds will be put into regulated status because they drain so much area.

Margaret S. reiterated that Ponds have to be included in the because we have a gap in reduction and the IP must show us meeting of goal of attaining water quality standards. We need to know how expensive they are going to be so we include them but know we would only implement them as a last resort.
Sharon C. suggested getting an estimate on areas treated through stormwater ponds estimates. James B. said he thought $200 is more realistic of an estimate than $20. Margaret S. suggested that we leave the estimate at $200 for the time being and ask the Gov/Res group in the evening if they have better numbers on acres treated for retention ponds, given the number of sediment ponds which the County likely has installed.

In the call last week it was discussed working with the horse community for education. Hanover was going to work with Ram and May on this. We want to try and stick that under an existing BMP so we don't have to come up with efficiency. Sharon C. said she thought it was a good fit under pasture management, we can try and those who would benefit in the office and get them information.

Margaret asked the group what are the educational needs regarding agriculture?
James B. asked do we have any idea about traditional methods for cows? Sharon C. said if there is a way of putting in more education we would be happy with that, even getting the people to come to the SWCD for help. Targeted education for horse folks is different than targeted education for agricultural producers. Margaret can check with Henricopolos for their needs for agriculture or they can provide their thoughts and can add them to the minutes.

James B. asked if when we put together this big document will there be an executive summary? If we focus on writing for the general population then that will be good. We don't want it to be intimidating.

Megan S. suggested that we could produce a fact sheet for these if you wanted a really short summary. Margaret S. suggested that could be something the steering committee could put together.

There was a discussion of the timeline of implementation. Margaret stated if you want the phases to be different, then pelase let her and Mohammad know because as it stands, by default they will probably go with phase 1 for 10 years, and phase 2 would be 10 years, with 20 years total implementation timeline. Ram G. requested the total should be 10 years total for each phase.

James B. stated he would like to have a monitoring component in the IP. Margaret S. clarified that there is always a monitoring strategy included in the plan… and that we can delve into more with the steering committee. Margaret did reflect on recent converstations between DCR and DEQ regarding when post-IP monitoring should begin. She explained that the DEQ didn't think it a best use of monitoring dollars to begin monitoring right after IP was completed because unless BMPs are implemented we're unlikely to see a change. Some regions use a threshold of 50% BMPs implemented but DCR is not happy with that and the agencies are trying to develop a happier medium. PRO does not use that threshold currently. Input would be appreciated when it gets to that point.

Ram G. said that since the contractor has all the files of where the BMPs are going and where they should be, that should dictate which stations for post-IP monitoring are selected. He suggested we look at subsheds to see what will need monitoring. He stated that he has seen before, that there is no link between the monitoring station and the BMP.
Margaret S. said what we can do is focus monitoring in areas where we have impairments and also their tributaries. As we go through the IP, DEQ won't know where the BMPs have been installed unless we

see it or someone tells us. We're happy to incorporate stations to bracket BMPs or problem areas. Just because the monitoring plan is formalized in the IP, doesn't mean we can't alter it.

James B. asked what if we have people that install BMPs do their own monitoring with coli scan, or have a local group monitor nearby to see how it works? That would save DEQ monitoring dollars and allows citizens to "own" part of the project. He stated the samples that groups send to DCLS are usually in agreement with DEQ samples 95% of the time.

Meeting adjourned at approximately Noon.

Second Residential/Government (combined) Working Group Meeting

Chickahominy River and Tributaries - Bacteria TMDL Implementation Plan Development
Residential / Government Combined Work Group - Second Meeting
August 20, 2012
2:05 PM – 4:40 PM

In Attendance: Margaret Smigo (DEQ), Mark Alling (DEQ), Megan Sommers-Bascone (DCR), May Sligh (DCR), Mike Dieter (Hanover Co.), Olivia Hall (Henrico Co.), Marchelle Sossong (Henrico), Grace LeRose (City of Richmond), Ashley Parks (EEE Consultant for VDOT), James Beckley (citizen), Jody Bryan (citizen), Lynn P. Wilson (citizen), Christine Beish (citizen)

Meeting convened at 2:05 pm. Margaret began the meeting with a brief overview of the response to comments from the first meetings in June 2012, which are almost complete.

Ms. Smigo - The draft TMDL will go to EPA for review. The first workgroup BMPs were modeled by Maptech from loads and reductions needed and were placed online with the first meeting minutes. There is a revised list of BMPs and cost estimates in handouts for this meeting. From the first meeting minutes only J. Beckley had revisions.

Ms. Smigo – DEQ combined the Government and Residential WGs because each group deals with the same information and BMPs. The goals of the second meeting are to finalize types of BMPs, costs, and technical resources needed for BMPs. The primary goal of the meeting will be revising BMP estimates, with secondarily reviewing/revising educational needs.

Ms. Smigo - Christine Beish, James Beckley, and Olivia Hall from this meeting will be on the Steering Committee. Others at the meeting were invited – participation has not been limited. The Steering committee will review and help draft specific tasks in the Implementation Plan. (IP).

Ms. Smigo – BMP efficiencies from the James River Bacterial TMDL IP will be used for the Chickahominy River Bacterial TMDL IP.

Ms. Beish– Where are the efficiencies? Ms. Smigo – In a table in the handout (from James River – City of Richmond IP).

Ms. Smigo – The In the handout, impaired waters are in the table on page 2. We removed the subwatershed map from today's agenda.

Ms. Smigo – There are 5 year and 10 year implementation phases to meet reductions (or whatever time frame the working/steering folks would like to suggest - this is flexible). Wildlife is considered a background condition, although occasionally the DGIF can be consulted with Canada goose or raccoon problem resolution (nuisance populations).

Ms. Beish– How does IP information get to the DGIF? Ms. Smigo replied that we contact them with our needs. Christine will share a photo of geese in her area. She has interests in developing an educational program for those in her community regarding the ~100 geese in her area.

Ms. Smigo – Page 3 describes 2 BMPs in Table 1, grass filter strips and sediment retention / control devices. DEQ does not have the number and location data (DCR has information in database – exact locations of installed BMPs are kept private to protect the landowner).

Mr. Dieter asked if local data are included. Ms. Smigo replied that information was pulled from the DCR database. Mr. Dieter says the DCR database was updated for the Ches Bay TMDL, but we need it for watersheds – comments were made suggesting that not all BMPs were included in database (numbers looked low). Ms.Sommers-Bascone can find this in her database. It is unknown how often the database is updated.

James B. stated that costs of sediment retention basins were discussed in the agricultural WG meeting this morning. Is there any cost or area for these available by county? The TMDL modeler used $200 cost / acre treated. What do stormwater retention basins actually cost? Ms. Smigo stated that we needed to know how many acres treated for the stormwater retention basins (not acre constructed). Mr. Dieter stated that he could provide some examples of cost per acre treated from Hanover Co. He stated he knew offhand that was $13600 / impervious acre treated is a well known cost estimate for these. Margaret asked that if he could provide other examples from the County it might be beneficial to see variation. It is questionable as to whether these sediment retention basins are the same as "retention ponds" needed in the project.

Ms. Sligh – She stated the % efficiencies for sediment retention basins was 50% and for bioretention basins was 90%. These were in the York IP document.

Ms. Hall asked for an email requesting this information. Ms. Smigo said she would email everyone.(***NOTE – Margaret isn't sure of what this is a reference to – whether it was for the York IP document or the efficiencies in the James River – City of Richmond IP. The latter were included in the handout. Please advise if there was a different intention not mentioned here.)

Ms. LeRose asked if DCR planned to do _____regularly. DCR replied yes. (Mark was unable to catch this – please advise if you can fill in the blank)

Ms. Smigo – We really need BMP specifications, costs, and % efficiencies. We can include anything in the main BMP tables as long as there is an efficiency associated with it that is defensible.

Mr. Dieter – Hanover Co. already supplied this information. Stormwater retention ponds and sediment basins are temporary, so these are less expensive. Mr. Deiter said he could provide these costs.

Ms. Smigo – On page 4, on residential BMPs, 25 of 35 straight pipes are to be replaced by sewer connections. Ms. Sossong – 70% is too high for percent of straight pipes fixed by sewer connection.

Mr. Dieter stated that failed septic systems cost $7800 to connect to sewer, but that it costs $31,838 per household when building a new subdivision. This $31K is not included in the IP cost estimates. Ms. Smigo stated we do not know which will be new builds. Mr. Dieter stated that we can seek needed funds by mentioning the $31K for all new hook-ups.

Ms. Beish– New building is not an option in some areas, to which Mr. Dieter agreed.

Mr. Beckley added _____. (Mark wasn't able to catch this – please fill in the blank).

Mr. Dieter and Ms. LeRose stated there were septic systems not connected to the public water system (that was how Richmond was able to help determine septic vs sewer numbers in James River City of Richmond IP). Ms. LeRose stated some of these could be septic failures.

Ms. Smigo needs to know which septic system hook-ups will be $7800 and which will be $31,838. Mr. Dieter uses that information and a GIS layer to know where the sanitary sewer will expand house hookups in these areas will be the $31,838. Ms. Sossong asked where these are. Mr. Dieter stated some subdivisions pay the $31,838. Hanover Co. tries to get grants. Some 50 home subdivisions with 50 homes on septic systems cost $millions. 230 units are needed in Table 2. Zero of those have sewer connections available. It is much too expensive per house. Ms. Sligh asked if there are community sewerage systems. Mr. Dieter stated none in Hanover Co. Mr. Dieter said that the 230 X $7800 was wrong. Most will be $31,838 because there is no sewer there.

Ms. Bryan stated that if sewer was available, there would be a house there. And that the number of homes in Hanover Co. was very low.

Ms. LeRose said the number not connected in the City of Richmond ~ 10%.

Ms. Bryan stated that failed septic systems are not an option at $7800, that $31,838 is more accurate.

Mr. Dieter stated that clusters of neighborhoods are without municipal sewer and there are no plans to retrofit them. Sewer service is only available in service areas and the Board of Supervisors is not ready to raise taxes for sewerage outside of the service areas. Ms. Smigo then said that we will not know which is $7800 vs. $31,838. Mr. Beckley had a solution: If connected to water but not sewer, then that home has a septic system. He remembered this from work time in Sussex Co.

Ms. Sligh asked if sewer connection is required at time of sale in Hanover Co. Mr. Dieter said no.

Ms. Bryan stated that inspection of the septic system is required at time of sale or a buyer cannot get a loan. Ms. LeRose stated that in the City of Richmond a home sold without a septic system repair and at closing the realtor got a bill for an $8000 sewer repair.

Mr. Dieter will provide the number of people not connected in sewer areas which should assist in determining which to apply at $7800 and at $31,838.

Ms. Wilson asked whether pumpouts are required and if there are compliance figures for pumpouts. Ms. Smigo stated that home must be pumped out on a 5 yr. schedule in the Ches Bay Pres. Area. Ms. LeRose stated that VDH sends a letter requiring pumpout but that no receipt is required for compliance. Ms. Sligh stated that Ches. Bay Local Assistance dept. (CBLAD) will check on pumpouts completed. Ms. Wilson said that obtaining pumpout compliance would help watersheds. Ms. Sligh said that CBLAD gets county reports. Ms. Hall stated that compliance is not zero, but also is not 100%. Ms. Wilson wants to know pumpout compliance figures, and wherever compliance is low, that area should be targeted for improvements. Mr. Beckley suggested that letters could be sent for non-compliance. Ms. Hall stated that Septic systems can be identified in GIS, and asked which counties had done this?

Ms. Smigo asked if Henrico Co. has a sewer system layer, with the percent of homes not connected to the line vs. those where a sewer line has not been built yet. Ms. Hall said that the letters they send are often not returned.

Ms, LeRose stated that in the City of Richmond, 10% of homes are one on city water but not sewer. Ms. Smigo asked if that is available for the Chickahominy basin only. Ms. LeRose will check. Mr. Dieter stated that he cannot break that information down by watershed in Hanover Co. Ms. Bryan suggested doing that by zip code or by tax maps. Ms. Wilson asked that was needed by subdivision or just generally. Ms. Bryan said that just depended on what is available. Mr. Dieter said one of these may be possible to do, but is it worth it because there would still not be money available.

Ms. Bryan said that a homeowner may not know if their septic system is failing unless water comes up in the yard.

Ms. LeRose stated that Chesterfield Co. found lots of straight pipes.

Ms. Smigo said it's possible to estimate pumpouts, needs to be agreement on the best way. Ms. Sligh stated that cost share criteria should be available by low income % in county. Ms. Smigo asked whether counties and city want more educational money to encourage pumpouts in the IP. Ms. Wilson suggested that if there is no reply to a pumpout letter, the county should send a second letter. Ms. Hall stated that all Henrico pumpouts are in a database, if a homeowner does

not pump out they get a letter. If there is no response, they get a second letter (and two staff people to perform educational component in communities). Ms. LeRose said there are staff in Richmond tasked with this as well. Hanover also sends letters to reach compliance with the pumpout requirement and includes educational pamphlets.

Mr. Beckley stated that in the first government WG meeting, people could get a reduced rate for sewage pumpouts. Ms. Hall agreed. Mr. Dieter stated that 3/4th of homes in Hanover Co. are in the Ches. Bay protection area (all of project area is within the area).

Ms. Smigo asked if we can offer an incentive for pumpouts – if that was something the group would like to include in the IP. Ms. Hall said that Henrico is already sending educational information out. She asked in the IP what is the compliance level for each county for different septic scenarios. Ms. Hall said this is interesting but the problem is that pumpouts are termed "mandatory", but are not enforced. Ms. Smigo, Bryan and Parks stated all BMPs are voluntary in an IP. Ms. Smigo stated that none of the BMPs in the plan are intended to end up in facility permits.

Ms. Smigo stated that there is a BMP for pumpouts in the manual, they weren't initially included in this IP because pumpouts are considered "mandatory" every 5 years within the watershed. Mr. Dieter asked if there is a correlation between septic failures and pumpouts. Ms. Smigo said she can get data on this from VDH. (Follow up – Margaret found the following materials which could be read as reference: http://www.wakegov.com/NR/rdonlyres/C50E57E3-F027-4CF9-8E59-23F710F5713A/0/WakeCountySepticSystemStudy.pdf (education important), http://ndwrcdp.werf.org/documents/04-DEC-7/04-DEC-7TechnicalGuide.pdf (over-pumping can be detrimental to biological function)

Ms. Wilson again stated that we need to have data on pumpout compliance. Ms. Smigo asked the group again for a decision on more educational funds for pumpouts. There was no decision from the group. Ms. Wilson suggested staff could take pumpout letters door to door. Ms. Smigo asked Mr. Dieter for a copy of Hanover's pumpout letter and suggested the IP could include funds for a part-time staff person for door to door letters (Henrico has two staff members who do this). Ms. Beish suggested adding signage in septic problem areas too.

Ms. Sligh and Ms. Sommers asked if there might be a group interested in educational program for pumpouts, perhaps a "septic social"? Margaret, in the interest of time moved the conversation along and can include pumpout in the IP for low-medium income (sliding scale) homeowners. To do this, it would help if localities could provide the % of homes in non-compliance with the mandatory pumpout requirement. That % could be applied to the number of homes that meet

low-medium income criteria in order to derive a number of pumpouts needed. The educational aspect for pumpouts was left undecided because it was unclear of what need exists. Margaret suggested the steering committee revisit the education-pumpout item at a later time.

In Table 2 in the handout, Ms. Smigo asked if localities have bioretention, perhaps as in large raingardens. Ms. Sligh used a cost of $15000 in her last IP (York) for bioretention and stated this practice was included only in the last phase of the IP. Mr. Dieter said the maximum size is about 3 acres for this practice. Ms. Sommers-Bascone suggested using the James River – City of Richmond IP figures.

Ms. Smigo stated that rainbarrels were not included because there was sufficient reduction in other BMPs. They are primarily a volume reduction type BMP and collect rainwater from roofs which are not known to be large contributors of bacteria. Ms. Smigo said that in areas with CSOs, rainbarrels were used because the volume reduction is important in that scenario. Ms. LeRose stated we should focus on the cheapest BMPs and should include rainbarrels in this project.

Mr. Beckley said that if 1000 gallons of rain fall and 100 gallons are captured in rain barrels, that is a 10% flow reduction. Ms. Sommers-Bascone stated we should include raingardens and barrels so that there will be grant funding available.

Ms. LeRose stated we need consistency between the James and Chickahominy River IPs. If rainbarrels are in the James, they should be in the Chickahominy. Mr. Beckley stated we should not include rain barrels because there is not a significant bacterial reduction for them. Ms. Sligh said that DCR already has programs for rain barrels, why not get credit for them and include them? Ms. LeRose and Parks stated that anything that reduces stormwater volume helps, and rainbarrels are a good tool in educational programs. Ms. Sommers-Bascone added _____. (Please fill in what was missed).

Ms. Sligh said that rain barrels may not be feasible on every property. Ms. Beish said that many people would not want a dog waste composter, but rainbarrels would be more popular. Rainbarrels can retain some water which would otherwise flow over yards (potentially with dog or other wastes) to the waterway.

Mr. Dieter stated that Hanover sent out 4000 letters promoting pet composters but got only 40 responses. Forty composters were installed on the ground . Ms. Smigo said she needs this kind

of information from counties and the city. Mr. Dieter reminded all that 40 responses does not automatically mean 40 composters on the ground (or within the Chick watershed). Ms. LeRose says the city sent out 15,000 letters for composters and got 75 responses. Pet composters may reduce bacteria from pet waste when they are used but its difficult to get a measure of compliance once they have been distributed. They could be installed and never used or even sold/redistributed elsewhere so they might not be the best answer (though they aren't very expensive).

Ms. Smigo stated rainbarrels, education for pet waste and pumpouts, etc could go into an educational BMP. She needs efficiency % for rainbarrels, but the reduction is in volume not in bacteria so we would have to come to an agreement on what to use. Ms. Beish says that rainbarrels should be included in a home audit program, and should be in the table. Determining a cost estimate will also be tricky for a BMP such as this. Ms. Sligh suggested using $5000 per educational program with 50% efficiency, so that one educ. Prog per county equaled $5000 per county. She also suggested 20 pet waste digesters per county @$50. She also mention kennel club septic systems (k-9 cafo). She said in the York there was a pilot for a confined canine unit for kennals was estimated at @$20,000 per unit in 7 subwatersheds (one per subwatershed) at 100% bacteria reduction efficiency.. She also said that dogs now stay in kennels all year, whereas previously it was thought they were only kept in the kennels during hunting season.

Mr. Beckley asked if these numbers included veterinarians. Mr. Dieter asked if there are no standards for these? Ms. Sligh stated she talked with the Orange Co. kennel humane society about a cost share option, or place waste in a shallow ditch to be dried by sunlight, or a dog waster digester, as in the Moores Creek watershed. That could be an option for a more urban area.Ms. Smigo asked if we should include one k-9 cafo per watershed or per subwatershed? We do not have known dog kennels in the Chickahominy watershed, but could suggest one per sub watershed. Ms. Sligh and Beish concurred. Margaret suggested that to avoid over-estimating the need, the group include 1 of these systems per allocated subwatershed (11 subsheds). Should the need arise, the IP has them included. There was no opposition to this suggestion. If anyone knows of a kennel where such systems could be used please let Margaret know.

Ms. Smigo said raingardens cost $0.50 per ft2 in James River – City of Richmond IP, is this an acceptable cost for rain gardens? Ms. Sossong asked if these are retrofitted. Ms. Smigo said that to her knowledge all rain gardens are assumed to be retrofitted. Ms. LeRose asked if that meant 1000 ft2 costs $500. Margaret said she believe that to be correct.

Ms. Beish asked that the IP will differentiate between rain gardens and bioretention, this is confusing. Mr. Beckley said that a quarter acre raingarden does not drain a whole quarter acre. Ms. Smigo will ask the MapTech consultant to differentiate between raingardens and bioretention though she believes it will largely depend on site-specific needs. Perhaps a total

acreage needed for bioretention/raingardens and then in another section of text state average raingarden size as opposed to bioretention size?

Ms. Smigo stated that in the handout we are now using 14.5 acres at $360/ac for vegetative buffer, and will include a description in the table. Group mentioned this number looked more appropriate than the original. Margaret was unsure if the estimates included both sides of streams or only one side – she will ask Maptech. The group was inclined to think it only included one side of the stream. Ms. LeRose asked if this was like stream restoration, to which Ms. Smigo said no, was only the buffer along riparian area. Mr. Dieter stated that stream restoration costs $250 / linear ft. Ms. Beish wants stream restoration in the IP if it can be included. Mr. Dieter and Ms. Beish agreed that the cost of stream restoration is for one side of a creek, the same as stream buffers. Ms. Smigo stated that the Maptech consultant prefers to use acres for stream buffers, there's still the question of one or both sides needing a buffer. One side may not need a buffer.

Ms. Smigo stated that in the IP and handout, pet waste composters eliminated the need to retention basins in residential areas., and if 2-dogs homes were used, only 11000 composters were needed. Ms. Hall asked what are the maintenance needs of a pet waste composter? Someone commented that enzymes must be added on a regular basis. Ms. Sligh suggested getting the number of planned communities, estimate 5 – 10 pet waster composters per neighborhood. Ms. LeRose and Ms. Sligh agreed that the number of composters in the IP handout are way too high and not likely to be fully implementable. Mr. Dieter said that Hanover gave away composters and only got a 1% response rate, he suggested using no more than 1000 pet-waste composters for the IP. Ms. Smigo stated she could reduce composters but it would bring back the need for retention basins.

Ms. Smigo asked if there were any objections to using a 50% efficiency rate for the pet-waste education BMP from Ms. Sligh's source (York IP), and the group said no. The James River – City of Richmond IP cited an efficiency of only 25%. Increasing this efficiency might help us when we decrease pet-waste composter numbers (to keep retention ponds needed low).

In a discussion of pet-waste education programs and needs, Mr. Dieter stated that in Hanover, neighborhoods volunteered to pay for recycling and add pet waste bag stations. Ms. Beish said that corn starch bags are better than plastic and Margaret stated that the cost estimate in the James River –City of Richmond IP were for cornstarch (biodegradable) bags. Ms. Smigo suggested using 250 pet waste stations, all in group agreed. Mr. Beckley asked if $the cost of 0.50 per mailing for the pet litter program (includes printing and mailing) was correct, Ms. Smigo said yes.

Ms. Hall had concerns about educational programs, people will call for proper disposal of waste. She wants a guidance document, as in is it OK to flush or bury dog waste, i.e. what is OK to do?. Someone referenced there is an EPA guidance document in the EPA MS4 website or the BMP clearing house.

Ms. Smigo asked how localities plan to reduce SSOs to zero, a 100% reduction was required in the TMDL. What would it cost to completely eliminate SSOs? Mr. Dieter and Ms. LeRose said it could not be done.

Ms. Smigo asked what would it take to reduce SSOs as much as possible – what additional things could localities do on top of what they are already doing to further reduce overflows and if money/time/staff were no object? To answer this, Ms. Sossong stated that the storm size (100? year storm) must be specified. Ms. LeRose said most SSOs are caused by grease clogging lines, and a grease trap would be needed on every house to prevent that. Ms. Sossong said there was no way to reduce overflows to 0. Ms. LeRose stated that the answer could be to fully fund the WQIP for $400-500 million.Mr. Dieter said he would ask Hanover Co. what they would do to eliminate all SSOs. Mr. Alling asked how much capacity would you use to stop all SSOs from pump stations, and estimate the cost from that. Ms. Sossong again asked storm size. Ms. LeRose said that TS. Gaston was a 1000 yr storm, and capacity could never be built for that size. Mr. Alling suggested a 100 yr storm size. Ms. Sossong said that Henrico's plan is to be able to catch all 10 yr storms in the future. Mr. Alling suggested localities provide an estimate with regard to the number of $billions it might cost. I & I is what brings stormwater into sewer lines. Mr. Beckley said do I & I surveys such as those performed by Sussex Co.Ms. Smigo asked Henrico, Hanover, and Richmond to ask managers what they would need to remove all SSOs and let her know. The IP should illustrate what localities are already doing with regard to SSOs (Henrico has provided very detailed information, but more information is needed from Hanover and City of Richmond to include on existing compliance for SSOs). Margaret reiterated that the purpose of estimates is to get localities funding to be used toward reduction of SSOs – they just need to let us know what their needs are. If more education is needed for citizens to reduce FOG (fats, oils, grease) that could be part of education program, if it's capacity, give us some details and costs and we'll include it as a BMP, if its I&I – what are specs and costs to enhance whatever you're currently implementing.

There was a question as to whether LID would benefit SSO reduction and a short conversation followed. Margaret suggested that roof rentention would prevent stormwater from reaching the ground and potentially reduce seepage into the lines. There was not an agreement with regard to pervious pavers however because those would increase infiltration (and possibly seepage into lines).

Margaret thanked the participants for their efforts in the working groups and meeting adjourned at 5:30 pm.

Meeting concluded at 16:40 pm.

Steering Committee Meeting Minutes
Steering committee meeting – FINAL Minutes
Meeting: 11/27/12 @ 2 pm Minutes finalized: 12/17/12
Follow-ups to meeting questions or clarifications are addressed in italics

In Attendance: May Sligh (DCR), Megan Sommers (DCR), Ram Gupta (DCR), James Beckley (Board – SWCDs, Citizen), Olivia Hall (Henrico Co.), Christine Beish (Citizen), Jody Bryant (Citizen), Margaret Smigo (DEQ - facilitating), Kelley West (DEQ - scribe)

Following introductions, Margaret explained the meeting objective were to review the revised BMP estimates, BMP efficiencies, and draft public meeting presentation. Margaret provided the group with three handouts; a spreadsheet of the BMPs by program types within two main categories of residential vs. agriculture BMPs to show the breakdown of unit estimates and costs, a sheet of the bacteria efficiencies by BMP, and a printout of the slides which show the same type of information as the spreadsheet does which are slides included in the presentation.

Margaret stated that often, a summary of the previous minutes are sometimes compiled and the group will go over those, however she felt that the existing minutes available for each meeting are available if we need to return to them. If there are any questions about how we arrived at any figure within the worksheet, she's happy to go over that if need be and the group was encouraged to ask questions.

Spreadsheet review:

Pet Waste:

May said that in order to establish pet waste stations you must work through the locality to make sure they are going to maintain the trash pickup of the trash from the pet waste stations. To assure that maintenance will occur, there should be included in the write up a blurb that the localities working or HOA's maintaining them, as long as there is a responsible party identified. *This can be accommodated in the IP document.*

Household mailings:

Ram asked if the educational mailings per household? *Mailings are based on the number of households within the Chickahominy watershed.*

James suggested for mailings, Henrico and Hanover and includes the language in a water bill or annual water quality report and you will be getting out to the majority of people and save money on postage and envelopes. Christine said Hanover has already worked with her on a neighbor hood program so they probably will work with us on such projects as this. *This can be a recommendation in the IP document to increase efficiency and save money.*

Olivia asked when stage 1 starts during this process or if it's after the IP has been approved? Henrico has already applied for grant money for some of the things on the list and want them to count if they put them in which is anticipated for 2013. *BMPs implemented at the beginning of 2012 and forward count towards implemented BMPs for this project. This is because the*

"existing condition" was modeled at the end of 2011, so all BMPs implemented after that day would be counted toward the total goal.

Christine asked what was the number from the draft last time for the composters? Margaret said the last handout contained an estimate of 16,500. Based on feedback, those have been reduced to 2510 in our current worksheet. James said there may be more benefit to put in pet waste stations instead of in pet waste composters, 20 will not stretch very far. Christine agreed, but felt we should not remove the composters completely. *The number of pet waste stations have been more than doubled (went from 20 to 50 watershed-wide) and the number of pet waste composters have been left as-is (2510 assuming 2 dogs per household). Reducing pet waste composter numbers would dramatically increase the quantity of other BMPs needed to reach the goal of attainment in the model. Pet waste composters are in stage II of the project, and hopefully the number actually needed, will be far less than what is called for in the model.*

James suggested we break up the numbers of pet waste stations per phases and making sure we break them up during phases. Advertise for people to adopt a station. Margaret said right now, 75% of the stations would be installed during stage I and 25% in stage II. Olivia said Henrico has already decided to put 5 pet waste stations in public area for 2013. May was thinking that at her neighborhood only put in the bag stations without the trash receptacle. There was a concern that the receptacle would not be maintained. However, Olivia said in Henrico, they had an issue in one area where when no receptacle was provided, people were tossing baggies in the storm sewer. *As mentioned in the previous page under pet-waste, verbiage suggesting that groups address maintenance of pet-waste stations prior to implementation can be accommodated in the IP document.*

Septics:

Ram asked do the counties have hookups included in their comp plans over the next 5 years? Margaret stated Maptech used the county layers to see the area they can hook up, given the number of homes in the area it's a reasonable amount of homes given the failure rate. Olivia said we have so many requests per year of people that want to hook up and public works would have this number

Ram clarified that there must be the ability within the treatment system/system capacity for that many homes to be connected. The counties should confirm whether or not they can connect that many homes, or else the BMP is unachievable and we should reduce the sewer connections, and replace with alternative systems. *Maptech provided the break-out of sewer connections by locality, Hanover 160 and Henrico 90. The failing septic systems were estimated as a fixed percentage in the TMDL, and Hanover and Henrico were the two localities with the the potential for sewer connections (New Kent and Charles City do not have this potential to our knowledge). There is no way of pinpointing where the failing systems are within either locality but both localities have knowledge of existing septic system parcels and can prioritize areas based on cost or areas known to have a high percentage of septic failures. The cost estimate for septic failures was provided by Hanover County ($32,000 per home connected to sewer) which included all infrastructure needs. Mr. Dieter, by email, also confirmed that capacity (160 homes estimated for connection) would not be an issue. Marchelle Sossong with Henrico County, responded that the capacity would not be an issue (about 90 homes estimated for connection) but they are not*

certain about whether the cost estimate provided by Hanover Co. would be an appropriate estimate for Henrico. Margaret provided a map of known septic parcels within Henrico within the Chickahominy watershed to assist them in determining an appropriate estimate. Henrico hopes to have a cost estimate response by next week (week of Dec 17th). Therefore, to answer Ram's question- no, capacity is not expected to be not an issue for the stage I of implementation. The cost estimate for Henrico's sewer connections may change.

OTHER RESIDENTIAL

Margaret stated that retention basins are a last resort BMP since sometimes permitting can be involved.

James and Margaret discussed that the way rain gardens are displayed in the table (per acre) it's difficult to see the actual number of raingardens which would need to be installed. If using a 200sq' raingarden as a default, they discussed the calculation. *The calculations performed on the fly to estimate the number of raingardens needed in the meeting were off by quite a bit. We are now using the same cost estimates that were used in the Richmond IP which were $19000 per treated pervious acre and $94000 per treated impervious acre. The original estimate was $19,000 per acres treated by raingarden. The total acreage of developed areas treated by rain gardens was reduced by half and now stands at 500 acres. The 500 acres are split into 150 impervious acres at $94000 an acre and 350 pervious acres at $19000 an acre for a total of $20.75 Million.. There was a request to increase the percentage implementation in stage I to 50%, which has been accommodated.*

Margaret mentioned that for bioretention basins, they treat parking lots, roof tops into a larger type of rain garden. She said Hanover provided cost estimates from Hanover as they had some projects completed and sent us acres treated and cost. *The cost estimates and number of bioretention ponds will be updated in similar fashion as raingardens.*

Ram stated that for retention ponds, the number installed depended on the slope. It's based on the elevations on the topo, sometimes the pond can treat only 50 acres, and sometimes it can treat 200 acres. *To clarify, the BMP table did not include a number of retention ponds needed in the watershed. Rather, the table included the number of acres treated by a retention ponds in order to get the needed bacteria reduction. These are a last resort to meet attainment in stage II. The question Ram posed was whether the number of 5,000 acres treated is feasible. Feasibility for constructing a pond can be based on physical constraints, cost constraints, regulatory constraints and land-ownership constraints. Dealing with land-ownership constraints is beyond the scope of this study, since it would first require that we identify where specific structures should go, and then require a specific analysis for each location. Regulatory constraints would be similar because they would involve a wetlands determination at each specific site. As far as cost constraints go, we've got a cost estimate and potential funding sources, so it's up to the individual stakeholder or stakeholder group, working with the local conservation folks, to determine if the practice is economically feasible. That leaves physical constraints. If we know that the acreage exists in the watershed, then, by definition, there are locations in the watershed where the drainage can be treated with a pond. To summarize the answer to the question, yes,*

by default the BMP is feasible because acreage exists which can be treated by retention ponds.

The group expressed their interest in changing the efficiencies of retention ponds. Margaret asked, if we were to change the efficiency for retention ponds what should it be? We need to include them to meet our goal. May expressed that DCR was urging developers away from retention basins. James suggested if we are looking to treat 5000 acres in an old retention pond that's a lot of large area, if we are trying to get away from that kind of treatment we need to try and put something else in. *While the group expressed an interest in changing this as well as other efficiencies for BMPs, no alternatives have been provided, nor has any evidence been provided to confirm the current estimates are invalid. No alternatives or their efficiencies have been suggested. Part of the difficulty of substituting LID practices for more conventional BMPs it has been very difficult to identify efficiencies for the LID practices (with regard to bacteria). Most of the research is nutrient-based or volume-based. As an alternative and in the interest of time, text regarding LID practices and their anticipated/potential, but unquantified benefits for reducing bacteria could be added to the document. They would be included in the "promotable practices" table and a narrative regarding them (as was done in the James IP) will be included.*

Christine asked is there a way to calculate efficiency even if we have not seen it anywhere else; she would be interested in finding the goose and other efficiencies. *Margaret had previously spoken with the DGIF avian expert who knew of no research to determine bacteria reduction efficiencies of current nuisance wildlife management practices. This was relayed in previous emails regarding wildlife management practices.*

James mentioned the group could use the document as a vehicle to promote practices (rain gardens are great but can be hard for the homeowner to do because of HOA approval). Margaret mentioned she was happy to put any language in the document to help with what the steering considered necessary.

Christine asked why are so many rain gardens in the 2nd stage, its popular so shouldn't we break it up evenly in between the stages? Margaret asked what would be preferred and the group would like to see them split 50/50 between stages. *The raingardens have been allocated 50/50 by stage.*

Ram stated, for bio retention pervious areas and impervious areas the cost will be different. The cost will be much higher than 19000 for pervious areas, impervious 94000 will be okay. *To clarify, the table included for bioretention units, "developed" as the bacteria source. "Developed" includes pervious and impervious fractions within the total. The impervious portion is 30% while the pervious portion is 70%. During the James River IP development, it was determined that the costs of impervious ($94,000 acre treated) and pervious ($19,0000 acre treated) bioretention were different. Ram suggested the costs be separated out by type and this change has been accommodated. Mohammad will breakdown the 500 acre of developed treated with rain gardens into 150 acres of impervious at $94,000 an acre and 350 pervious acres at $19,000 an acre. He will also break down the 200 acre treated with bioretention into 60 acre of impervious and 140 acre of pervious at the same cost conversion as rain gardens).*

May- BMP clearing house might give good guidance for cost, there is a link to it on our website.

James- the bacteria will be close to sediment because bacteria cling to sediment. *Clarification – James stated that the bacteria loading is tied to sediment runoff. Therefore, if you stop sediment runoff, you will stop most bacteria runoff (nonpoint source of bacteria).*

James- the vegetative buffer is saying it's going to be 20000 feet in length. What buffer ft are we assuming? Margret responded 35ft. What efficiency is it? Margaret directed the group to the efficiency table, which has efficiency of 100% within the buffer and 50% of an area equal to ½. James questioned the treatment efficiencies; he thought they were probably ½ of that amount. Christine agreed. Margaret asked if he could provide some type of citation to justify the change. *While the group expressed an interest in changing this as well as other efficiencies for BMPs, no alternatives have been provided, nor has any evidence been given to confirm the current estimates are invalid. The efficiency used for vegetative buffers are those used in the Chesapeake Bay model for sediment. Therefore, there is justification to continue with the efficiency we currently have. For clarification, the efficiency is not stating that a buffer is any given width (ie- 100 ft wide or 50 foot wide) rather it is saying that buffers have an excellent reduction efficiency within the buffer itself and 50% efficiency on areas adjacent to the buffer and up to double the area of the buffer. For example, a 1000 ft buffer (35 ft wide) on a developed area will have 100% efficiency on a portion of the developed area equaling 3,500 square feet (1000 * 35') and 50% efficiency on a portion of the developed area equaling 7,000 square feet (1000 * 35' * 2). The reason we limit the impact of the buffer to its area and twice its area from adjacent areas is that for areas beyond that, even if their flow path goes through the buffer, this flow will be concentrated and will not get filtered by the buffer. Buffers only filter flow when it passes the buffer as sheet flow.*

Ag-BMPs:

The horse waste composter has 99% efficiency. We were thinking if someone got a composter they would have to participate in a workshop in order to get part of the cost back. This is very similar to the pet waste program.

Fencing:

Christine- is there a way to count how many cattle farms are in the watershed? Margaret said during the IP that the SWCDs were able to help with the population numbers because they know the majority of the farms and their locations. However, based on our populations noted in the TMDL, there are more horses in the watershed than cattle.

Ram noted that intermittent streams can be included for cost share on a case by case basis. Margaret responded that she understands, however DCR requested that we separate out the fencing units in order to let the SWCDs know how many would qualify for cost share and how many would not. We have no idea of knowing what the "case-by-case" basis will result in.

Ram said regarding the average fencing length number, in each IP the contractor has determined a watershed specific number and it should not be based on the number from another IP watershed. *Mohammad calculated the potential length per system based on GIS by grouping fencing segments that look like they should be grouped based on aerial photography and came up with 1,100 ft per system (which is closer to the 840 ft per system suggested in the first WG*

meeting). The change of the average system length from 2100' to 1100' resulted in a change in the cost per system. The cost per system has been revised based on the following components: 1 well = $5000 + 1 pump= $2600 + 2 watering troughs = $3000 +pipeline = $1000 + 1100ft @ $2/ft=$3300 = $14,900 per system (based on 2008 estimates from Gary Boring at New River Highlands RC&D). The total number of systems is of course higher now that the length per system went down.

Ram stated the LE-1T is reasonable cost, SL6 is reasonable, and SL-6 can be combined with LE-1T. Margaret said she could combine LE-1T and SL6 as long as there wasn't some reason by the districts to keep them separate. *LE-1T has been combined with SL6 at the request of the group.*

Mohammad has provided updates to fencing numbers in the attached table. The ~ 3300 feet of fencing already installed in the watershed will be assumed as 3 systems (each around 1100 ft) so the total number of systems still needed is the calculated number -3. The adjusted fencing numbers were derived as follows:
-Total length of stream-length available: 127695 ft
*-Half is for horses therefore, the number of systems for horses is 127695 * 0.5 / 1100 = 58 - systems (assumed non-cost share).*
*-Cattle non-cost share (stream-length along intermittent streams) is 127695 * 0.7 / 1100 ~ 41 systems*
*Cattle cost share (stream-length along perennial streams) is 127695 * 0.3 / 1100 ~ 18 systems.*
Total length of 3200 ft has already been installed equaling 3 systems in the watershed. This leaves 15 systems to be implemented of the 18. We will have 2 WP-2Ts and 13 LE-1Ts.

Christine- on the James R. table the BMP's such as the shallow marsh and submerged gravel wetland, are they different than rain gardens? Margaret responded that yes they are different, they are engineered systems.

Draft Presentation:

Slide 4-James, can we change the color from yellow to something easier to see? *James was referring to to the impairment map, and yes the color can be changed.*

James- will you specifically talk about fecal bacteria in these slides instead of just bacteria? *Yes, the facilitator will elaborate.*

Slide 13- check and see if these are counted in stage one, or if we do more. And what date will stage 1 start. *As mentioned in a previous page, the implemented BMPs are those done beginning in 2012, after the "existing condition" was modeled for TMDL development at the end of 2011. The practices displayed in this slide are considered "done" in the watershed. We would subtract what has been done in the watershed if 1) If the practice was done after "existing condition" modeling was performed, or 2) If the BMP in the plan suggests ALL possible be implemented. An example of the latter is stream fencing, where 3200' has been installed (based on 1100' per system ~3systems). Since the TMDL calls for 100% of cattle access to be eliminated, we must subtract the "done" systems to see what is available for new implementation. 127695' available for fencing/1100' per system = 118 systems – 3 done systems =114 systems to implement.*

Slide 16- remove a lot of the extra data from the slide, only show big bullets and not include the explanation. *Will revise this slide.*

Slide 16- get rid of sl6 and group le1 and sl6 together. *Will combine the two practices.*

Slide 35- can we break it up and have federal on one slide and state/local funds on another? *Yes*

Discussion about wildlife reduction:

James- there is the 77% wildlife reduction; you might want to put it in the end something about reducing wildlife if none of these steps work. Margaret responded that in the IP document, we always reference the ability to conduct a UAA, however, we are usually pretty explicit that wildlife loads are background, and our TMDLs are conservative. While reductions are high, we don't expect it will be necessary to make all reductions called for within the IP. The monitoring data determines when we are done, not the number of implemented practices. *DEQ does not typically address wildlife reductions in implementation. Wildlife sources of bacteria are considered background loads, and it is debatable as to whether this is a source which should be reduced. However, several of the BMPs in the IP will remediate a portion of wildlife loads. "Nuisance" wildlife management will be a promotable BMP in the document.*

Ram- can you distinguish between the nuisance populations and say contact local authorities? *We cannot separate nuisance wildlife numbers from wildlife numbers in general. We can make the distinction that nuisance wildlife can and should be managed with proven, effective BMPs. Language reflecting appropriate promotable BMPS for nuisance wildlife will be included in the document.*

James- should we include a workshop bmp for residential to include this?

Jodie- can we have contacts for master gardeners, they already have some of this outreach established, it may not be on a chart or measurable. DGIF has programs, nwf has programs, and we can just have ways to direct people to those programs. We don't have to add this to the IP, I just want you to keep your eyes open to programs already in place.

Margaret- what else for this IP do we need to add about a residential workshop?

James- stormwater runoff, pet waste, nuisance wildlife,

Christine- 3-4 workshops about $1000 a workshop, only during stage 1,

Olivia- the county has an interest in this due to recent algal blooms in the area; it will help with nutrient reductions also.

James- I will talk to SWCD and I could potentially teach one, can we leave it open for who is teaching it? A booklet would work also.

A residential workshop using information provided by stakeholders has been added within stage I of implementation. The components of the workshop are as follows : $1000 for each workshop (total $5000), $4.66 per booklet (~50pp/workshop = $1165), and $0.41 for ad copies (50

ads/workshop = total $20.50), and for newspaper notices $125 per notice (x5 (one workshop per year)= total $625). The workshops would teach homeowners about the BMPs they could install on their own properties, proper lawn management, stormwater management, pet waste management, resident goose management and human techniques for reducing their impacts to water quality, septic/sewer owner tips and maintenance, as well as teaching water quality basics and introduce them to citizen monitoring in the watershed.

In correspondence with Hanover SWCD, it was decided that the 1,775 acres of Reforestation of Erodible Crop/Pasture (FR-1) should be removed, due to concerns that it would encourage farmers to convert viable farmland to forest.

The meeting adjourned at 4:30pm.

APPENDIX B

Example of How to start a Pet Waste Pick-Up Campaign

How to Guide: Pet Waste Station Community Program

Based on Arundel on the Bay Program, Annapolis, Maryland
Written April, 2010 [adapted here to apply to JR – COR]

This is a description of the elements needed for setting up a neighborhood or community based Pet Waste Station Program. The elements of the community pet waste program are:

1. **Lead Coordinator**
2. **Pet waste station equipment**
3. **Permits**
4. **Station Maintenance**
5. **Outreach**

1. Lead Coordinator

Identify a lead person in the community who will coordinate all things related to pet waste stations. This person ideally should live in the community and their duties will include coordination to:

- Order of station parts and store stock of refill bags (both dog bags and trash can liners).
- Obtain a county permit for station installations [if needed].
- Insure assembly and installation of stations.
- Insure maintenance of stations (minimal); insures contractor is removing full bags.
- Be in contact with the other neighborhood committees who deal with common area services and maintenance to coordinate activities related to these areas.
- Provide outreach about the dog waste stations.

2. Pet Waste Station Equipment: Pet Station Equipment and Bag Order

Note: other sources and types of equipment are available; this company was chosen as the best price competitive against three other bids in spring 2009; equipment was chosen based on price and potential for durability in salt air environment. The source is: http://www.belson.com/pwds.htm

- One station is about $350.00 for parts:
- Pet litter bag dispenser (comes with 400 bags); DP-1002-2; **$90.00**; Quantity = 1 Recommend ordering extra bags and storing with neighbor lead coordinator
- 10 gallon round waste receptacle (aluminum green); DP-1206; **$180.00**; Quantity = 1
- Heavy waste bag receptacle liner bags; DP-1404**; $19.00**; Quantity = 1 Recommend ordering extra waste bag receptacle liners and storing with neighbor lead coordinator
- 2" X 2" square mounting post - 4' to 8' telescopic post galvanized; DP-1301-P; **$61.00**; Quantity = 1

Assembly and Installation

- Assembly is based on the equipment described above. It is simple to assemble, requires two people and about 40 minutes per station. A screw driver, wrench and socket are required. Consider asking a neighborhood Boy Scout, who will earn community service credit for assisting, for help.
- Installation, after site selection and permitting, can be completed by a neighbor or contractor.
- Prior to installation day, mark selected sites with surveyor's paint.
- DoodyCalls installs stations: (http://www.doodycalls.com/pooper_scooper_virginia_richmond_henrico.asp)

Site Selection for Stations

- Work with the community home owner's association.
- Consider locations that are on community property. Avoid private property.
- Locations need to be on the route that people are known to use when walking dogs. Talk with the dog owners and observe the area for a few weeks prior to final site selection.
- Locations need to be accessible, visible (without impairing view lanes), yet far enough off of the road to be safely away from snow plows and areas needed for access by public utility service vehicles.

3. Permits

Before installation, make sure a permit is not required from the local county/city.

4. Maintenance

- The primary maintenance tasks are emptying the trash can liner full of used dog bags and replacing a new trash can liner, and replacing the dog bag with refills as necessary.
- We encourage that trash filled with dog waste go to the land fill where it becomes both controlled and a point source (by being part of the land fill).
- DoodyCalls maintains stations: (http://www.doodycalls.com/pooper_scooper_virginia_richmond_henrico.asp)
- All bag refills (dog poop bags and trash can liners) are provided to the contractor by the community through the lead coordinator to contractor.

5. Outreach

Possible Sign Messages:

- Picking up your pet's waste helps keep our water clean.
- Pet waste contains bacteria which damages the Chesapeake Bay's waters.
- Rainwater will carry these pollutants to the Bay.
- Removal of pet waste is required by [indicate local ordinance here]
- Neighbors will like NOT having to avoid doggie poop while out walking.

- Location of pet waste stations.
- Periodic reminders to community that the stations are there and recommending continual use.

Create a Google Map showing the locations of the pet waste stations in your community.

Outreach opportunities:

- Community newsletter.
- Community web site.
- Community email list serve messages.
- Announcements at community parties, gatherings, home owner general meetings.
- If you have a dog, on walks, talk up the pet stations with neighbors while walking your dog.
- Letter to local paper editor letting them know that pet waste stations are now in your neighborhood and well accepted!

Original Author and Contact: Julie Winters, Master Watershed Steward
winterstime@aol.com

APPENDIX C

Public Comments and Responses

Good Afternoon,

Thank you for your comments on the Chickahominy River & Tributaries Bacteria IP. We appreciate the time and effort of your review and hope the changes made are to your satisfaction.

If you have any additional questions with regard to changes made in the IP or would like to discuss any of the comments/responses in greater detail, please do not hesitate to give me a call.

Best Regards,

Margaret Smigo

DEQ-Piedmont Regional TMDL Coordinator

(804)527-5124

From: Lunsford, Charlie (DCR)
Sent: Monday, March 11, 2013 6:13 PM
To: Smigo, Margaret (DEQ)
Cc: Gupta, Ram (DCR); Sligh, May (DCR); Sommers, Megan (DCR)
Subject: Comments on Chickahominy River & Tributaries IP

Margaret,

See attached comments.

Thanks.

Charlie

DEQ Response to Review Comments Prepared by DCR -
Draft Bacteria Implementation Plan Development for Chickahominy River and Tributaries
Submitted March 8, 2013 - DEQ Response (in italics) provided May 29, 2013

General: Draft IP document is well written. Assessment actions needed, IP goals and milestone sections are concise and explained well. Following edits and/or clarifications are suggested to be included in the final version for clarity and stakeholders' better understanding.

Check fonts for consistency throughout document, especially in appendix. Also due to right justify formatting, some lines have only a few words on them, section 7.1 which is due to a web address. Consider doing a hard return for the websites, and then resuming the right justify, when this occurs.

Not sure why street sweeping details need to be in this IP document; does not really affect bacteria

Specifics:

Executive Summary and text within draft: B-1 numbers seem high (5,234 in stage-1 and 5,234 in stage 2). It is suggested to include either the source and/or a brief method on how these numbers were arrived at.

DEQ appreciates your comment, however, the Executive Summary serves as a brief synopsis of what the IP includes details regarding how these numbers were derived are in respective sections of the IP.

X Last line, add… SSOs with reductions needed in wildlife direct and land-based sources.

Thank you, this change has been made.

Xii Table ES2. – The number of retention ponds in Phase 2 seems high. Pump outs seem high too, but if have a plan for prioritizing may be ok. Sewer connection # seems unrealistic ….may consider breaking up into Phase 1,2,3. Number of Rain Gardens seems unreasonable too. Also, Is it best to use vegetated buffers at $1 per foot or should they be at a $400/acre rate?

DEQ appreciates your comment, however, the working groups and steering committee have discussed these estimates (please see meeting minutes on the DEQ website). The methods for deriving each number are documented in the IP. It is not clear how breaking the phases up into thirds will facilitate attainment of water quality goals, unless the idea is to increase the IP timeframe. The connection numbers were validated using GIS shapefiles for sewer service areas supplied by localities. If you have additional questions or concerns please contact the Piedmont Regional Office to discuss.

Xiii 3rd para, 2nd line, Just above "Measurable Goals" section: ….among the best measure**s**

Thank you, this change has been made.

Xiii Last para - stage-2 will not be having all control measure to achieve load reductions needed to achieve water quality goals as stated in TMDL. Since TMDL also states 100% SSOs reductions, and stage-2 will not be having these, a statement clarifying this needed.

The following two sentences have been added at the end of the paragraph mentioned, " Wildlife reductions however are not called for in the IP. Moreover, and even though localities are conducting major improvements to address the issue of SSOs, completely eliminating SSOs is a monumental task that may never be realized."

Xiv 4th para, 4th line - consider replacing "obtain" implementation milestones" with "achieve"
Thank you, this change has been made.

Xv "properly handling of (remove of) horse waste"

Thank you, this change has been made.

Section 3.9 don't end sentence with preposition "for"

Thank you, this change has been made.

Page 5-4 indicate "feet" along with 128,000.

Thank you, this change has been made.

Page 5-8 cost-share amount is not only available for perennial streams, but also for intermittent streams when and if needed on critical areas within watershed - revise text at few places as needed in the draft.

The term has been changed to " Cattle Fencing on Intermittent Streams" rather than "non-cost-share cattle fencing" throughout the document.

Page 5-11 same as above

The term has been changed to " Cattle Fencing on Intermittent Streams" rather than "non-cost-share cattle fencing" throughout the document.

Page 5-15 septic and straight pipes number shown - Are these same as in TMDL study or revised? If revised, then would be good to indicate either source or brief method on how these numbers were arrived at.

The numbers used are the same as stated in the TMDL.

Page 5-16 As indicated in ES, RB-1 number (10,468) seems high.

While DEQ appreciates your comment, during the working group and steering committee meetings the numbers estimated and method used was accepted and paragraph three on pg.5-16 explains how the number was derived.

Section 6.3 The targeting approach for residential practices in Section 6.3 is interesting, but will that really be practical for use during implementation?

While DEQ appreciates your comment, we are not sure of why the approach would be unsuccessful. If you would like to indicate appropriate alternatives, we would be happy to include them.

Section 8 Funding source - Include the Chesapeake Bay Restoration Fund (http://dls.state.va.us/groups/cbrfac/guidelns.htm) The fund supports environmental education and action-oriented conservation and restoration projects within Virginia's Chesapeake Bay watershed. Applications are accepted from state agencies, local governments, and public or private not-for-profit agencies, institutions, or organizations. This fund could potentially be a good source of funding for educational programs included in the IP.

Also, add the Department of Forestry **Virginia Trees for Clean Water** program which is designed to improve water quality in the Chesapeake Bay by planting riparian buffers and trees in our neighborhoods and communities.

Thank you, this change has been made.

Appendices It is better to have public document brief and concise. Appendix may be included in technical document, if it is being prepared.

The public document and technical document is contained within the single draft. A summary of the report is found in the Executive Summary as well as the public meeting presentations.

Comments provided by Charlie Lunsford (DCR):
Table 5-3 use whole numbers.

Thank you, this change has been made.

Table 5.1 use the term “pasture management” in place of “Prescribed Grazing Plan and Implementation” to be consistent with terminology being used universally in VA TMDL IPs. In the table you can reference NRCS 528 because pasture management follows the specifications of this NRCS standard. DCR has a pasture management BMP (SL-10T) that is being piloted with (3) Districts in the state. In the text pasture management and Prescribed Grazing with Implementation are both used. The cost per acre needs to be adjusted down from $150 per acre to $75-$90 per acre. NRCS pays $30 per acre over a three year contract and DCR is paying $25 per acre over a three year contract.

The IP was changed to reflect the change from "Prescribed Grazing Plan and Implementation" to "improved pasture management", however, the cost was kept the same because it was based on local feedback.

Vegetated buffers on cropland and residential land are universally quantified in VA TMDL IPs on a cost per acre and not cost per foot. The vegetative buffers on cropland are cost-shared on a rate per acre both by DCR and NRCS (WQ-1 is the DCR specification, NRCS 393), going cost per acre $400.

Based on discussions during the IP working groups, the decision was made to use length instead of area and the group agreed on $1 per foot.

How can the sewer connection per connection be justified at $32,000? The cost estimate for the RB-2 practice is based on the cost to connect a dwelling with a straight pipe or failing septic system to an existing sewer line. According to Megan Sommers (personal communication) in the working group a cost of $7,800 per residence was mentioned to connect a failing septic system to the public sewer. There was also mention of the cost to connect new construction in a subdivision (per residence) being $32,000. The IP does not address cost for new construction for sewer. It would be helpful as a future reference to have maps in the Technical Report as to the areas in the Chickahominy River watershed where there is potential for sewer connections.

The cost figure is based on lengthy discussions with Hanover and Henrico Counties based on the costs for sewer connection in addition to the basic connection fees. This information is documented in the working group and steering committee minutes. The localities have provided sewer service areas within the GIS shapefiles. While these maps were not included in the IP, which also serves as the technical document, they can be provided upon request.

The language on page 5-9, second paragraph is inaccurate. Aerial photography cannot be used to identify the number of fencing systems needed in a watershed. First of all, there is not a map product available were you can clearly see the existing fence line and the tree canopy also covers up existing fences. It appears that Map Tech probably looked at the pasture parcels along a stream either on one side or two sites and came up with a total of 118. Then the length of fence was totaled for the 118 pastures and divided by 118 to get the 1, 100' average length. Livestock exclusion systems are planned and designed based on FSA farm field tracts. Did the consultant use this data layer in the analysis? Based on the reasons mentioned here you cannot do the fencing system estimates by aerial photography. THE TMDL program has quantified feet of stream fencing needed from the imagery and divided this number by the average feet of fencing for systems historically installed in the watershed from DCR's Agricultural Cost-share Database. We need to discuss this because the number of exclusion systems needs to be revised.

The method used was not to recategorize existing land use based on the location of existing fencing, but to check existing land use against recent aerial photography in order to derive a more appropriate length of streams in need of stream fencing. If the aerial map clearly differed with the land use, for example, if there was a subdivision in the aerial map where the land use indicated the area was pasture, and there was a waterbody within the area, it was concluded that stream fencing would not applicable. This method was used because when the entire stream network and existing

land use was utilized to estimate stream fencing needed, the estimate was deemed too high by members of the working group, including DCR. When only perennial streams and the land use were used, the feedback we received from the working group was that the number was too low. The correction of stream fencing using aerial photography and the land use was accepted because the estimated stream fencing needed seemed reasonable to the working group, including DCR.

The number of systems proposed is consistent with historic length on average and the needed total length was revised based on aerial photos. The historic average from previously developed SL6 systems was 840 ft which is close to the final number used in the IP (1100 ft). Please keep in mind that the 840 ft average was based on systems within the counties intersecting the study area, not the study area alone. If we take the average from only the systems within the study area, the average is 250 ft which would have resulted in approximately 500 systems of exclusion needed.

With regard to FSA farm field tracts, Maptech has attempted using them in the past but because they only give farm boundaries, it cannot be assumed that the area within the boundary is all pasture. Pasture land is needed to identify intersections with streams, in order to estimate stream fencing needed.

Page 5-17 please provide a reference for the basis of "install septic system with retro-fit filter at $4,500".

Thank you, this change has been made.

Found the terms "non-cost share cattle systems " and non-cost-share horse systems confusing in the table in the Executive Summary because I have not seen these terms used this way in an IP that I can recall. We have used the term "Voluntary Fencing" in referring to livestock exclusion that producers will do without cost-share assistance. On page 5-11 I found a description of exactly what these terms refer to. The livestock exclusion systems in the IP all may be applied on perennial and intermittent streams. The intermittent fencing would be in cases where fencing will exclude livestock from a water feature or area that can contribute a bacteria load directly to stream or in runoff even though it will be dependent upon times of year and rainfall. The text on page 5-17 refers to non-cost share cattle systems on intermittent streams and then state decisions on a case by case basis. This is all confusing. Also, we offer a practice SL-6AT for the exclusion of horses from streams so it is incorrect to say, " x" number of systems will be non-cost share horse systems.

The text was revised in tables and in description of practice as well stating that intermittent streams are eligible when located in critical areas (bottom of page 5.8).

Top of page 3-5, what other options are available for achieving bacteria reductions in the IP? This statement adds nothing to the IP and undermines the purpose of the process.

This sentence was removed.

In the BMP table in the Executive Summary there is a listing waste storage/composting/education – horse, $3,000/system =$21,500. Where in the document is this explained?

The table states "+" $21,500, not "=" $21,000 which is the fixed cost mentioned in Table 5.10. There is text above the tables which explains that these numbers were "...determined through literature review, analysis of the Virginia Agricultural BMP Database, and discussion with stakeholders and working group members". To ensure this is clear, the following sentence was added to the end of the paragraph above the table, "The $21,000 listed in the Waste Storage/Composting/Education – Horse measure is to cover the educational component of the program."

Comments from Ms. Wilson

From: Smigo, Margaret (DEQ)
Sent: Wednesday, May 29, 2013 1:54 PM
To: 'Lynn Wilson'
Cc: Beckley, James (DEQ); 'Jameson Brunkow'
Subject: DEQ response to Your Comment on TMDL IP for Bacteria in Chickahominy River - SSOs

Good Morning Ms. Wilson,

The TMDL staff at DEQ has been meeting with enforcement, compliance, and permitting staff with regard to the best path forward for working with localities for minimizing SSOs. We will continue our discussions to ensure that the language in TMDLs, IPs, consent orders, and permit documents are consistent with our goals of improving water quality.

This text was reviewed by Hanover Co and is under review by Henrico County. In the IP, the following text has been drafted for addition to section 7.1 Integration with Other Watershed Plans:

"Sanitary Sewer Overflow (SSO) Programs

Sanitary sewers are systems which collect wastewater from homes and businesses and transfer it through pipes and a series of pump stations to a treatment plant. Sewer systems are designed to accommodate a specific volume of wastewater. At the design volume, sanitary collection systems are not expected to overflow or release sewage before it is successfully delivered to the treatment plant. When wastewater exceeds design volume or if the capacity is reduced by a blockage in the piping system, wastewater will "back up" and sewage discharges may occur from the nearest escape location (i.e. manholes, pumping stations). These are illicit discharges to the environment and are called sanitary sewer overflows (SSOs). SSOs may contain raw or untreated sewage, which contaminate streams with bacteria, viruses, nutrients and other pollutants harmful to humans and wildlife. Wastewater can also enter the environment through exfiltration via line cracks, joint gaps, or breaks in the piping system, or due to infrastructure failure. Failures are typically addressed by the sewer system owner, usually counties or municipalities, when they occur and most have long-term programs whose function is to identify and repair damaged sewer lines and to address everyday maintenance issues.

The Chickahominy River and Tributaries bacteria TMDL required 100% reduction of SSOs. Like straight pipes and septic failures, SSOs are considered illicit discharges. Watershed wide, the SSOs contribute approximately 30% of the total annual bacteria load. In comparison, the watershed-wide direct human source (from failing septic and straight pipes) is estimated to contribute about 4%

of the total bacteria loading. SSOs are not addressed as part of the treatment facility permit because they are illicit or "not permitted", rather, when they occur, they are addressed through compliance and enforcement actions. When a facility has repeated SSOs, they will be asked to enter an agreement called a "Consent Order", which is a formal agreement between DEQ and the facility which includes a schedule of compliance for sewer system improvements.

In the Chickahominy River watershed, the majority of observed SSO events (~98%) occur in Henrico County, followed by Hanover County (~2%), based on reporting from localities. The City of Richmond, Charles City and New Kent counties all have very few sewer networks within the Chickahominy River study area.

Henrico County entered into a Consent Order with DEQ beginning in 2010 with a schedule of compliance through 2017. The scheduled improvements include sewer rehabilitation and storage projects within Upham Brook, Trumpet Branch, Westham Creek, Horsepen Branch, and the Chickahominy River. For the purpose of proper sewer system operation and SSO correction, Henrico County Department of Public Utilities (DPU) maintains an Inflow and Infiltration (I&I) program. Development of this program required significant engineering evaluations to complete a Wet Weather Study and a Master Facilities Plan that included implementation of a system sewer model. Henrico County also developed a county?wide GIS system and other DPU applications in the collection, analysis and mapping of the data. The goal of the program is to correct I&I problems, repair damaged sewer lines, and address maintenance issues. The program is designed to reduce infiltration and inflow into the system, prevent sewage overflows, limit the number of sewer main stoppages, minimize O&M (operation and maintenance) costs, and provide safe and continuous service to sewer customers. The need for sewer rehabilitation projects are based on system-wide wet weather flow evaluations, customer complaints, evaluation by CCTV (closed-circuit television), sewer-main cleaning, and information collected during response to service calls. System improvements include cleaning and inspecting sewer pipes to identify defects; pipe line repairs; manhole inspection and repair; flow isolation and monitoring; smoke testing; dye testing; and CCTV inspection of both existing and new sewer lines. These activities and along with system information such as pipe age, pipe material, repair history, sewer backup and overflow records, and hydraulic capacity are combined and used to prioritize sewer line rehabilitation and/or replacement needs.

Related specifically to sanitary sewer overflows, Henrico County's I&I Program will incrementally improve the system response to wet weather impacts. By 2036, this program projects that a 10 year recurrence interval storm will be contained within the sanitary sewer without overflow. The Department of Public Utilities (DPU) Capital Improvement Program identifies projects based on the above stated criteria and projects the budget required to accomplish these goals. Projected budget needs specifically related to sewer rehabilitation and

wet weather control requirements over the next 25 years are estimated to range from $400,000,000 to $500,000,000 (these costs do not include annual operating budget costs for ongoing maintenance programs). The availability of funding is subject to annual appropriations by the Board of Supervisors. Henrico County DPU has projected a budget of $62,000,000 for sanitary sewer rehabilitation (I&I removal) projects over the next 5 years. Funding requests are reviewed and approved by the Board of Supervisors on an annual basis. Previous years funding requests have been approved and DPU will continue to present information for funding that can be supported in annual approvals by the Board of Supervisors.

Hanover County plans to continue their current activities which it states have been successful in minimizing SSO's. The County's Department of Public Utilities has an annual operating budget of about $17.5 million, about half of which is related to the operation and maintenance of its wastewater system. It is anticipated that these activities will increase in the future to keep up with growth and aging of the system. The County also plans to continue investing in the infrastructure of the system which is part of their capital improvement program. At the time of IP, no large scale improvement projects were focused soley on reducing SSO's, however, the County has future projects planned to increase capacity so that SSO's will not increase due to expansion of the collection system and to maintain its sewer collection system.

Due to the magnitude of bacteria which SSOs contribute to the Chickahominy River and tributaries, sanitary sewer improvements in both Henrico and Hanover Counties should continue in the future with appropriate funding provided.

Education and outreach programs for sanitary sewer customers could help alleviate SSOs which occur as a result of pipe blockages. Often, blockages in a sanitary system will occur due to a build-up of fats, oils and grease which are dumped into residential and commercial drains. A fats, oils, and grease (FOG) audit program for restaurants and pamphlets for homeowners can educate sewer patrons on proper disposal of "FOG" and the impact which improper disposal can have, such as SSOs in public waterways."

DEQ appreciates your participation in the development of the IP and your work as a citizen monitor and educator of water quality issues in the watershed.

Please let me know if you have any questions.

Best Regards,

Margaret Smigo
DEQ Piedmont Regional TMDL Coordinator
(804)527-5124

-----Original Message-----
From: Smigo, Margaret (DEQ)
Sent: Tuesday, February 19, 2013 12:13 PM
To: Lynn Wilson
Cc: Beckley, James (DEQ); Jameson Brunkow
Subject: RE: Comment TMDL Bacteria Chickahominy

Hello Ms. Wilson,

DEQ has received your public comment and will provide a response soon. Thank you for your participation and your commitment to improving water quality in the Chickahominy River watershed.

As a public document, your comments may be shared with local agencies in order to respond factually.

Best Regards,

Margaret Smigo
DEQ Piedmont Regional TMDL Coordinator

-----Original Message-----
From: Lynn Wilson [mailto:lynnpeacewilson@gmail.com]
Sent: Tuesday, February 12, 2013 10:02 PM
To: Smigo, Margaret (DEQ)
Cc: Beckley, James (DEQ); Jameson Brunkow
Subject: Comment TMDL Bacteria Chickahominy

Margaret, in the TMDL IP the SSOs and what the counties are doing about them should be documented. It is quite likely that the SSOs are a major if not THE major contributor to e coli contamination of the river. In Henrico, very little money is allocated for capital improvements of any kind these days.
Lynn